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UK: DRA Awards Stealth Materials Development Contract

BR1602144295 Kidlington *ADVANCED COMPOSITES BULLETIN* in English Jan 95 pp 10-11

[Unattributed article: "BTR and Courtaulds To Develop Stealth Materials"]

[FBIS Transcribed Text] BTR Materials Systems and Courtaulds Aerospace have won a second contract for the development of stealth materials from the UK's Defense Research Agency (DRA). The objective is to develop materials that are both radar-absorbent and can incorporate infra-red camouflage.

BTR Materials Systems was specifically established by the BTR group to focus on stealth materials and the company has considerable expertise in the area of radar-absorbing systems.

Courtaulds Aerospace specializes in the field of fabric-based products and advanced composites. Many of its products are used in lightweight composite armour for vehicles and personnel armour systems. Courtaulds will also bring its expertise in infra-red camouflage to the programme.

The contract for the development of "multi-spectral, low-observable materials and techniques" emanates from the Sensor and Signatures Division of DRA which is interested in the camouflage for all areas of defence structures for land, sea and air use.

UK: Ceramic Components Protect Turbines Against Cracks

95WS0213A Frankfurt/Main *FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT* in German 9 Feb 95 p 8

[Article: "Ceramics Patterned on Snail Shells"; "Alternating Layers of Carbide and Graphite Protect Against Fracturing"]

[FBIS Translated Text] Frankfurt—The design that renders snail shells resistant to breakage might also yield greater resistance for ceramic materials for turbines. Aircraft engines and gas-turbine generators could operate more efficiently and produce fewer pollutants. Calling

attention to this are researchers at Cambridge University who, jointly with three European firms, have been successfully experimenting with a prototype.

The team of researchers around Bil Clegg has synthesized a ceramic from carbon and silicon carbide, an especially hard and chemical resistant material. The new ceramic consists of alternating 150-micrometer thin layers of carbide and five-micrometer thin layers of graphite. The filled-in layers prevent stresses in the material.

If tiny micro-fractures do form, the graphite keeps them from spreading over wider areas. The same principle occurs in the shells of Venus bivalves and snails. In their case, however, the layers consist of calcium carbonate and specific proteins, as the scientists have discovered.

If it is desired to apply this process to turbine blades, however, they have to be redesigned. At present they normally consist of metallic alloys. Since the temperature from the flame in a turbine reaches nearly 1,500°C, the blade has to be cooled with a current of air, since the alloys start decomposing at more than 1,000°C. The airfeed creates a small buffer zone that does, in fact, cool the turbine blade but simultaneously causes the temperature to increase to nearly 2,000°C at the interface between flame and air. At such temperatures atmospheric nitrogen and oxygen form poisonous nitrogen monoxide.

The new technology avoids the formation of nitrogen monoxide, since the ceramics dispense with air cooling. Up until now, however, the brittleness of many ceramic materials has been an insuperable problem. Most of those materials do not tolerate repeated heating and cooling, above all, although in and of themselves they are well resistant to high temperatures: ceramics only start melting at about 1,500°C.

The researchers got the silicon carbide from the British ICI [Imperial Chemical Industries] subsidiary Tioxide. The French firm Ceramiques et Composites produced the ceramic and Germany's Motors and Turbines Union (MTU) Munich GmbH [Limited] produced the prototypes. The tests were also conducted at MTU. In them a ceramic combustion machine was repeatedly heated to 1,485°C, as reported by the journal *NEW SCIENTIST* (1995, Nr. 1960, p. 22). The next stage is to be full-blown laboratory tests.

Space Agency Ministerial Conference Announced for October in Toulouse

BR0103130595 Paris AFP SCIENCES in French
22 Feb 95 p 15

[Unattributed report: "The European Space Conference Will Be Held 18-20 October in Toulouse"]

[FBIS Translated Text] The 15 European ministers in charge of space-related issues will meet in Toulouse on 18-20 October. This was announced on 7 February by Mayor Mr. Dominique Baudis, referring to a letter from Jose Rossi, minister of industry, post, and telecommunications.

The European Space Conference takes place every three years. The last one was in Grenada in Spain. The Toulouse conference will decide on Europe's participation in the international R-Alpha station.

European Companies Form Joint Regional Air Venture

95WS0218A Paris AIR & COSMOS/AVIATION
INTERNATIONAL in French 3 Feb 95 p 11

[Article by Bernard Bombeau: "British Aerospace, Aerospatiale, and Alenia Join Forces in Regional Aviation"]

[FBIS Translated Text] ATR and BAe [British Aerospace] sign a protocol creating a joint-venture company to build the regional aircraft that account for more than one-fourth of the market. The accord holds promise of wider Europeanization...

After many vagaries and more than a year of negotiations, Aerospatiale (France), Alenia (Finmeccanica group, Italy), and British Aerospace (United Kingdom) announced on 26 January the signing of a draft agreement that calls for creation of a European regional transport aircraft building company. Ownership would be divided equally among the three partners, which are currently producing ATR and Jetstream turboprops and Avro International Aerospace's regional jets. The agreement, signed in Paris, calls for operations of the future company to begin with the merger of the marketing, sales, and after-sales activities of ATR, Avro, and Jetstream into an integrated organization that will also be responsible for development of all new aircraft.

The headquarters of the company will be in Toulouse, but the partners will keep all their existing industrial and financial bases in their home countries. Each builder will remain project leader for its current programs, but the joint-venture will be responsible for any new aircraft program.

For the three partners, this first signing ceremony consolidates the last step before "realization of what ideally will be an even greater industrial integration," in the framework of a company whose formation "will be subject to negotiating formal accords and obtaining the necessary regulatory authorizations." The parties involved have agreed that "these negotiations will be conducted on a basis of exclusivity." In other words, between now and the ratification of such an accord—expected to be finalized within the next 3 to 6 months—none of the current

partners can enter separate negotiations with foreign companies not parties to the 26 January agreement. The clause does not mean, however, that the door will necessarily be closed to other potential partners such as Sweden's Saab, Spain's CASA [Spanish Air Manufacturing Inc.], and above all Germany's Daimler Benz Aerospace (DASA), whose entry in turn would bring in the Dornier company and Dutch builder Fokker.

Indeed, it is precisely with this objective that so much effort in the last several years has gone into creating a real European commuter-aircraft hub. Everyone agreed that six rival European builders was simply too many: They would oversaturate the market, and they couldn't all survive.

If, for now at least, DASA remains on the sidelines, its weight nevertheless looms heavy over the negotiations. For it looks as though the agreement partners will not find it easy to build a European 100-110 seat aircraft without the Munich-based giant, which wants to go into partnership with the Asian partner of its choice.

More Markets

Such an idea is not all that far from the strategy pursued by Aerospatiale, which is holding separate talks with both China and Korea. But Paris believes choosing an Asiatic partner in a widened consortium would make sense only on the basis of a common European decision, within an already-united European industry. A thinly veiled way of opposing Boeing's Asiatic ambitions without necessarily implying a division of labor at the European level.

The alliance of British Aerospace and ATR strengthens the position of the three aircraft builders in the market niche of regional aircraft of 19-100 seats. Jetstream adds to ATR's 45-70 seat regional transport turboprops its own J-41 30-seat model. Avro contributes its high-end four-jet RJ, which carries 70-100 passengers. The latter category now holds 37 percent of the 65-120 seat market niche. That market share far surpasses that of Jetstream, whose penetration in the North American 30-seat market is at best 4 percent, compared to 8 percent in Europe and 7 percent in Asia (ATR statistics). The Franco-Italian consortium [i.e., ATR] for its part claims large market shares in Europe (23 percent), Asia (19 percent), and North America (17 percent), with 435 aircraft delivered. Aside from BAe models (146), Avro today boasts 22 firm orders and 17 deliveries for its RJ line. Sales of Jetstream's J-41 to date total only 70, of which 35 have been put into service in the last 2 years.

Financially, such an alliance constitutes a real second wind for British Aerospace, whose annual losses from Jetstream and Avro are as high as 1.5 billion French francs [Fr]. But Jetstream, which will continue to commercialize the J-31 (19 seats), must sacrifice its J-61 (a rival to the ATR 72), which goes out of production by the end of the year. In tandem with this "restructuring" at the British end, BAe plans to set aside a 250-million-pound provision (about Fr2.12 billion), in its 1995-1996 profit-and-loss statement, to cover client risks and to implement a downsizing plan that should initially eliminate 800 jobs at its Prestwick facility (Scotland).

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The regional air transport market has grown steadily since 1983, when the first new-generation aircraft went into service. The big builders agree there will be a need for 3,500-4,000 new aircraft in the 19-70-seat category over the next 10 years. And these figures do not even take into account the 80-110-seat market niche, which all sides see as a gold mine.

France: ONERA To Modernize S1 Wind Tunnel

95WS0192A Paris AIR & COSMOS/AVIATION
INTERNATIONAL in French 6 Jan 95 p 67

[Article by Christel Tardif: "Second Wind for S1"; introductory paragraph in boldface as published]

[FBIS Translated Text] **Europe's largest transonic wind tunnel, owned by ONERA [National Office for Aerospace Studies and Research], is acquiring new equipment and fulfilling its work plan for 1995.**

An old war prize repatriated from Austria and placed in service in 1953, the S1 wind tunnel at ONERA's Modane-Avrieux center has managed to keep up with technological changes, and today it is still an important member of Europe's stock of wind tunnels. With its test section measuring 8 meters in diameter and its flow of up to 10 metric tons of air per second, S1 is Europe's largest transonic wind tunnel. It intends to keep that privileged position, especially at a time when there is talk of organizing European research according to areas of competence.

Several steps have been taken with that in mind. To develop its activity in studying the dropping of payloads, the wind tunnel will soon have the largest captive tracking system in the world. Manufactured to the ONERA's specifications and now in the process of assembly, that system will handle models one-fifth the size of the full-scale object. A robot possessing six degrees of freedom and consisting of two stings—one supporting a model of the warplane, the other supporting that of the payload—it will enable researchers to study the behavior of the entire unit during the drop. It will be operational next year, and the Rafale will be its first commercial application.

In addition, to meet a growing demand for tests of aeroacoustic measurements, preparations are being made for a new test section. Financed by the DGAC (General Directorate of Civil Aviation), this test section will have anechoic properties at low speeds. It will thus compete with the Dutch DNW wind tunnel, currently the only one in Europe with a large-sized low-speed anechoic test section. The project should be completed in 1996.

Lastly, plans call for modernizing the control and data recording room, which is much too small at present. For that purpose, scales and calibration benches will be placed together in a new building constructed specifically to hold them, thus freeing up space around the test section.

Although in great demand during the time of the A340, A330, Rafale, Apache, and other programs, S1's activity has fallen off recently. But officials are very satisfied with its work plan for 1995. Testing of the captive tracking program for use on the Rafale is to begin this year, while

Deutsche Aerospace and Asian countries have signed on for several aerodynamic testing campaigns.

Moreover, the ONERA is engaged in talks with certain European countries with a view to using S1 for missile characterization tests. Those tests will be along the lines of the series of tests conducted on Matra's Apache missile (completed in July 1993), which led into aerodynamic tests, technical tests concerned with ejection of the air intake fairing, wing flare in airflow, engine starting, infrared and radar measurements, navigation resetting, and so on.

Eurocopter has also signed on for two rotor test campaigns. In this case, the big advantage of S1 is that it can handle large-scale models having a diameter of up to 4 meters. For that matter, the other participants in the European helicopter industry are greatly interested in that capability and have also submitted specific requests.

The wide diversity of tests conducted with S1 is due to its three interchangeable test sections (soon to be four). One of them is specifically designed for testing at very large angles of attack. Another possesses a floor with a blown boundary layer for low-speed tests and studies of ground effect. A third test section has been reinforced. It is used for purely aerodynamic tests, but also and especially for testing engines. For that last-named type of test, S1 has two major advantages: its size enables it to test full-scale engines such as the CFM56, and the fact that it is an atmospheric wind tunnel (in which cooling is effected by an exchange of air with the outside) guarantees that the airflow will not be contaminated by exhaust gases.

SNECMA To Build High-Pressure Unit for Future A340 Powerplant

95WS0218B Paris AIR & COSMOS/AVIATION
INTERNATIONAL in French 3 Feb 95 pp 16-17

[Article by Jean-Pierre Casamayou: "Promising Beginnings for SNECMA's 'PAT' High-Pressure Unit Demonstrator"]

[FBIS Translated Text] **The prototype of a high-pressure turbine unit destined for the engines of the A340 will be completed by March 1996...**

The government's recent decision to support aeronautical research (Cf. A&C No. 1503) is going to mean a shot in the arm for the PAT [Technological Action Plan] being implemented by SNECMA [National Company for the Design and Building of Aircraft Engines]. The plan calls for developing a high-pressure turbine module destined for a future medium-power civilian engine whose first application would be the A340. SNECMA engineers, pleased by the initial results, believe the first complete high-pressure turbine module (compressor, combustion chamber, and turbine) will be running by March 1996.

Officially launched in 1991, the program is one of those demonstrator-exploratory development hybrids so common in the military domain. The project has about a 1-billion-franc [Fr] cost ceiling, with 40 percent of the financing to be covered by the engine builder and the rest by the state. After detailed studies in 1991 and 1992, parts fabrication began in 1993 and continued last year. Testing

of the combustion chamber, which began last July in Villaroche, continues with 2 months of laboratory work at the DGA [General Delegation for Armaments] Propulsion Systems Testing Center.

SNECMA's avowed objective is ambitious. Its aim is to demonstrate successful test-bench performance of a high-pressure turbine unit at a "reduced-flow" rate of about 3 kilograms/second. It consists of an 11-stage compressor, a dual-head annular combustion chamber, and a two-stage turbine.

The high-pressure compressor, to be tested at Villaroche next September, will have a compression ratio in excess of 24. About 700 mm in diameter and 1,500 mm long, it will incorporate the latest techniques and technologies available. "As this compressor has been designed using the latest three-dimensional calculation codes, we expect performance better than that of the compressor that we developed for the GE90," says SNECMA technical director Jacques Caruel.

Two of the compressor's 11 stages will be fitted with a new monopiece bladed disk (DAM, or "blisk" in English) technology. This technology, which affords significant mass gain, is also the object of the "Centor" exploratory development program for the future M88-3 military engine. An important feature will be reduced blade clearance. Active control of blade clearance will be tested by controlled dilatation of the casings and by new brush-joint techniques to verify the chamber's ability to withstand the internal pressure. Also, experimental work will be done on a new technology for adjusting the variable stator. On the materials side, powder metallurgy will be used to fabricate the rear disks.

The combustion chamber, which has already demonstrated excellent results, is dual-headed in order to reduce the ratio of nitrogen oxides. "SNECMA pioneered this system with the premixing combustion chamber for Concorde's Olympus," the technical director noted. Besides greatly reducing the pollution, this system allows for a shorter combustion chamber and hence reduced engine length. It should also be noted that the chamber is cooled with a multiperforation device instead of the traditional air film. This affords mass gain and reduces manufacturing costs.

The high-pressure turbine is a two-stage device, because of the compressor's very high compression ratio. But also because, according to Jacques Caruel, "you get better yield with two stages than with one stage." A fact that shows, in passing, that this high-pressure turbine module is nicely adapted for an engine characterized by low fuel consumption. Thus too for the engines on a very long-range aircraft such as the A340. The blades will have cooled internal cavities, and their exteriors will be coated with a thermic insulation layer deposited by plasma bombardment, using

a new technology dubbed EBPVD (electron beam physical vapor deposition). This has two advantages: It economizes on the need for cool airflow, and it keeps the temperature much lower. Developing it is a major challenge for SNECMA: This is its first dual high-pressure turbine, and it is assigning its best engineers to this phase.

But SNECMA's technical director remains confident, because the French engine builder can build on all the know-how it acquired in developing the M88, whose turbine operates at the (world) record-breaking temperature of 1,850° Kelvin. In the compressor domain, in addition to military programs, the manufacturer has developed several high-pressure compressors for commercial engines. These include the GE36 demonstrator (a six-stage compressor that is a spin-off of the one for the M88) and the GE90 10-stage demonstrator that will make its first flight under the wings of a Boeing 777.

[box, p 17]

Toward "CFMXX"

The PAT demonstrator that SNECMA is developing could lay the foundations for the future high-thrust CFM56 which CFMI is considering. Currently known as the "CFMXX," this engine which should have total thrust between 160 and 220 kilonewtons (36,000-50,000 pounds) is destined initially for the "heavy" versions of the A340.

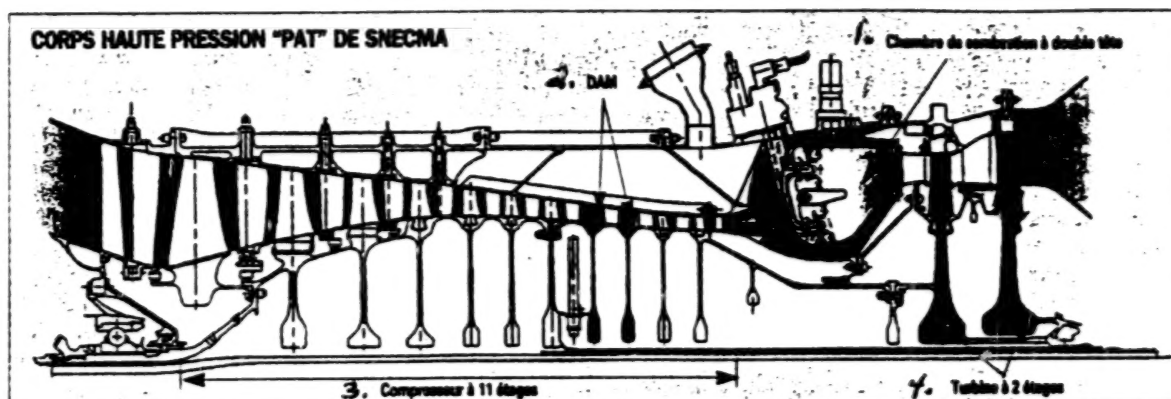
For SNECMA engineers, transforming this demonstrator into a high-pressure turbine unit for a developmental engine should not entail fundamental modifications. It should suffice to simply adjust the diameter of the compressor duct (and thus airflow) to accommodate the thrust required.

It will also be necessary to develop a conventional low-pressure module that uses a blower with a diameter between 2 and 2.25 m. This would be equipped with thick, hollow titanium blades. Such an engine would have a bypass ratio between 7 and 9.

If the project builds on the PAT demonstrator, the CFMXX could see the light of day within 24 months of its official launching. And certification could be obtained 22 months after that. The cost of developing such an engine is estimated at Fr6 billion, which would be borne equally by SNECMA and General Electric.

The other solution for developing this future engine would be to build a half-size GE90: the GE45. In that case, SNECMA engineers believe the work would be as complex and costly as developing a new high-pressure turbine unit from scratch. From their experience with General Electric's "E3," which they transformed into the high-pressure turbine unit for the GE90, they learned that compressors cannot be downsized by simple downscaling. More importantly, they do not believe such an engine would perform as well as one using a high-pressure module developed with the latest technologies and calculation codes. [end box]

SNECMA's "PAT" High-Pressure Turbine Unit



Key: 1. Dual-head combustion chamber—2. DAM (monopiece bladed disk, or "blisk")—3. 11-stage compressor—4. Two-stage turbine

Ariane 5 Core-Stage Engine Tests Successful

95WS0218C Paris AIR & COSMOS/AVIATION
INTERNATIONAL in French 3 Feb 95 p 40

[Article: "Successful Test of Ariane 5 Cryogenic Stage"]

[FBIS Translated Text] On 27 January there were three separate firings of the Ariane 5 cryogenic (Vulcan) engine at three different sites—one at the Ariane 5 launch zone in Kourou, during the BS-6 test of the cryogenic first-stage, and two 300-second static tests on test-beds PF50 at Vernon and PF5 at Lampoldshausen.

The BS-6 test-firing, of 215 seconds' duration, was the last in the series of "full-tanks" tests. Its purpose was to better demarcate the operations envelope, fine-tune certain adjustments, and continue with testing of the guidance systems, as well as to test three new tank pressurization system breakdown scenarios and engine shutdown on exhaustion of the oxygen. This series, dubbed "Battle-ship," began on 5 September with validation of the measuring and control systems. The first two launch chronologies, with filling and emptying of the tanks, took place on 22 and 27 September (the BS-1 tests). These were followed by launch-abort simulations on 18 and 27 October, the first effort having failed (BS-2). The next firing ran into several problems in keeping to the launch chronology. The first effort, on 6 December, failed following a problem with the ground-to-vehicle interface, while the second, on 8 December, had to be stopped after 10.4 seconds of operation due to a breakdown in the measuring system. The third try succeeded on 20 September, with duration nominal at 276.2 seconds (BS-3 tests). The fourth firing (BS-4) on 11 January lasted 212.5 seconds. It was used to test guidance, simulate electrical and pneumatic systems breakdowns, and for the first time test shutdown upon exhaustion of the oxygen. Consumption of the 700 kg of oxygen in the feeder lines allowed

ignition duration to be increased by 2.5 seconds. ESA [European Space Agency] (project director), CNES [National Center for Space Studies] (lead contractor), Aerospatiale (industrial architect), and SEP [European Propulsion Company] (testing program manager) decided to eliminate the BS-5 test because of good performance to date and instead just finish up the series with the BS-6 test. The series had 270 objectives, of which 49 percent related to preparation of the stage, 27 percent to powered-flight operations, and 24 percent to ground installations. The solid-fuel booster qualification tests are scheduled to begin 15 March (for Q1) and 15-20 June (for Q2, rather than May as earlier planned). Also, there is the final adjustment phase, with the MQ stage in flight configuration. This stage will be leaving Mureaux in early February for Kourou. The tests will begin on 15 March with a run-through of filling and emptying the tanks, followed by a first 600-second firing in April. There will be five firings between now and the end of July (plus an optional sixth). The MQ stage will also be used for the three qualifying tests scheduled for August. After which, beginning 1 October, preparations will get under way for the launch of flight AR 501, still scheduled for 29 November.

[box, p 40]

Ariane 4 Schedule

The next flight, V71, which was announced for the end of February, will now take place on 14 March (Hot Bird-1 and Brasilsat-B2 satellites). The slight delay is due to modifications to the third stage, which was already in Kourou. Flight V72 could take place about 10 April (ERS-2 [Earth Remote Sensing] satellite). The remaining launches should follow at the rate of one every 3 weeks. Thus there will probably be two launches in May and two in November. Flight V75 is expected in mid-June (Helios-1A), and the year's activities may conclude with the launch of V82 in mid-December. [end box]

France: New CNES Head on French, European Space Programs

95WS0217B Paris AIR & COSMOS/AVIATION
INTERNATIONAL in French 3 Feb 95 pp 39-40

[Interview with Andre Lebeau, president of the National Center for Space Studies [CNES], by Pierre Langereux and Christian Lardier; place and date not given: "Lebeau Discusses Manned Space Flight. Need for 'Sacrifices'"]

[FBIS Translated Text] A week after he was named by the Council of Ministers to head CNES, Andre Lebeau shares with AIR & COSMOS his first reflections on the French and European space programs...

[Langereux/Lardier] What led you to accept this position?

[Lebeau] Well, among other things, I'm very attached to CNES, a place where I've already spent 10 years. I've never really gotten completely out of the space business. For one thing, I've held the space technologies and programs chair at CNAM, and for another I've been director general of "Meteo France", president of the "Satellites" working group of WMO [World Meteorological Organization], and chairman of the board of EUMETSAT [European Meteorological Satellite Organization], which recently approved the second-generation METEOSAT program. Also, I believe a country that intends to have a space policy needs a national agency, and I consider it an honor to be called upon to head it.

[Langereux/Lardier] What is your mission?

[Lebeau] I don't yet have any instructions, but I will doubtless soon be given specific objectives by the government.

[Langereux/Lardier] What are your policy and objectives?

[Lebeau] I have a clear idea of the function of a space agency, which serves as an interface between industry and the political will of the government. As for our space policy, that's up to the government. But CNES's responsibility is to submit proposals to the government, and its expertise lies in its ability to steer the government toward intelligent decisions. It has no business leading the government down the primrose path, luring it into the pursuit of chimeras... Dialogue should enable us to formulate a sound space program. Once programs are decided, they must be implemented efficiently and rigorously, and the process should comport the greatest possible growth in industry's capacity and competitive position.

[Langereux/Lardier] What's your analysis of the French civilian and military space program?

[Lebeau] I wouldn't want to render any definitive opinions on that subject. I would first like to take the time to gain a better appreciation of the programs CNES is facing.

It is quite obvious, however, that in the Hermes program we have gone astray... We must seek the best balance between research and applications, civilian and military, French and European. This question is so important I don't want to make judgments prematurely.

[Langereux/Lardier] What do you think of the utility programs?

[Lebeau] The only domain that I really know well is earth observation. There, we have two major synergies: the first is between the experimental and the operational; the second is between civilian and military. My opinion is that the relationship between CNES and earth-observation users should be strengthened and more highly structured.

[Langereux/Lardier] Does your experience with Meteo France give you any ideas applicable to CNES?

[Lebeau] I think so. I spent 8 years as an end-user of space technology, waiting for national and European agencies to develop the tools we needed. That gave me a different perspective from the one I had as director of programs at CNES and later ESA [European Space Agency]. I've been at both ends of the spectrum, at the supplier end with CNES, and at the customer end with Meteo France. It's a useful experience, and I would add that relations between CNES and Meteo France have always been excellent.

[Langereux/Lardier] What do you have to say about the synergy between civilian and military space programs?

[Lebeau] There is a "community of interest" between civilian and military observation which—I'm choosing my words carefully here—should make increased synergy possible. Space has an important role to play in both civilian and military domains. Everything depends on the know-how, much of which is shared. We must start from these facts in determining how the state should organize itself.

[Langereux/Lardier] Do you have an opinion on the possible usefulness of a small launcher?

[Lebeau] CNES is going to have to make a judgment on that question. In my view, the need for a small launcher is not a fundamental issue for space policy. It is a question of expedience, which should be determined on the basis of many factors, including the market. One can envisage a national or European space policy either with or without a small launcher. It's not indispensable.

Concerning Ariane 5, the program is locked in and under way, there is no more time left for questions, we've simply got to make it succeed. And, at the same time, study ways of maintaining its competitiveness by further advances... On the question of fair and unfair competitive practices, Arianespace's position of trying to establish a "code of conduct" with its competitors makes a lot of sense. I am a strong believer in the virtues of international dialogue.

[Langereux/Lardier] What's your opinion of manned flights?

[Lebeau] To find a truly solid justification for them, we must look so far ahead that it's difficult to mobilize political support. For example, establishing a permanent presence on the moon can be justified from a scientific standpoint, but it is a very distant objective... In this area, we must therefore have a long-term strategy, while at the same time establishing intermediate objectives that are not so distant. Above all we must avoid any of the extreme positions: mobilizing too much of our resources for the short term, or too much for the long term—or abandoning the effort altogether. But this undertaking must be viewed in a European and international context, where the benefits of solidarity sometimes require sacrifices.

[Langereux/Lardier] Should we cooperate in Station Alpha?

[Lebeau] That is a question of space policy that must be decided by the government. CNES's role will be to impart wise counsel.

[Langereux/Lardier] What criticisms do you have of the European space program?

[Lebeau] The problem is the lack of sufficient convergence on objectives on the part of the member states. But that is precisely what we must achieve at the ministerial conference taking place in France in late September. To succeed, in my opinion, we must try for a "package of proposals," of the kind that in the past allowed us to get under way with METEOSAT, Ariane, Spacelab, etc. That approach was responsible for some extraordinary European successes. The European space program needs to find its second wind!

France: New CNES President, Members Profiled

BR0203130495 Paris AFP SCIENCES in French
22 Feb 95 p 14

[Unattributed report: "Mr. Andre Lebeau Is New President of the National Center for Space Studies"]

[FBIS Translated Text] Paris—Mr. Andre Lebeau, 62, was appointed on 25 January by the Council of Ministers as the president of CNES [National Center for Space Studies], replacing Mr. Rene Pellet, whose three-year term of office ended at the beginning of November.

A graduate of the Ecole Normale Supérieure, Mr. Lebeau is a physicist who is well familiar with space problems, but also a manager. Born on 4 March 1932 at Montceau-les-Mines (Saone-et-Loire), he had already served in CNES as director of industrial programs and plans before being its deputy director general, from 1972 to 1975. A specialist in space programs, a subject he has taught since 1980 at the National Conservatory of Arts and Professions (CNAM), Mr. Lebeau participated in the initial stage of the European space programs as assistant director general at the ESA [European Space Agency] in 1975. From 1986 to 1994, he served as director of the National Meteorological Service (which became Meteo-France last year). He has also been president of the council of EUMETSAT (European Organization for the Operation of Meteorological Satellites) for the last four years. Mr. Lebeau has been vice president of the World Meteorological Organization (OMM) since 1991.

He participated in the second antarctic expedition of the International Geophysical Year (1958) at Adelie Land, was director of the Ionospheric Research Group, and participated in the creation of the French Institute of Polar Science and Technology (IFSTP). He was president of French Polar Expeditions from 1987 to 1990. From 1980 to 1983, Mr. Lebeau was mission director of the City of Science and Industry of La Villette.

In addition to its president, the board of directors was also reshuffled:

Representatives of the state:

—Michel Fenier, scientific director of sensitive transfers in the general secretariat of the Defense Ministry;

—Jean-Pierre Rabault, director of missiles and space at the Defense Ministry;

—Frederic Grasset, director of economic and financial affairs at the Foreign Ministry;

—Jean-Francois Stoll, head of the economic expansion service at the Economy Ministry;

—Henri Serres, director of the communications and service industries service at the Industry Ministry;

—Francois Jonchere, deputy director of the budget department at the Budget Ministry;

—Pierre Potier, director general of research and technology at the Higher Education and Research Ministry.

Members chosen based on their expertise:

—Henri Marchal, president of the Caisse regionale de Credit agricole of Toulouse and the Toulouse region;

—Marcel Benichou, president of ONERA [National Office for Aerospace Studies and Research];

—Philippe Gahut d'Izern, deputy director general of Havas;

—Michel Feneyrol, director of CNET [National Center for Telecommunications Studies].

Personnel representatives:

—Helene Lassalle-Giraud, employee at CNES headquarters in Paris;

—Michel Le Meiget, employee of the Toulouse Space Center (CST);

—Martine Marceau, engineer at the Guyana Space Center (CSG);

—Henri Morand, engineer at CSG;

—Andre Richard, engineer at CST;

—Roger Roulet-Matton, employee at CST.

France-Italy: ATR Aircraft Undergo Icing Tests

95WS0205D Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 17 Jan 95 p 8

[Article by re: "ATR Aircraft Pass Icing Test"]

[FBIS Translated Text] Frankfurt—The turboprop aircraft from the French-Italian production consortium ATR may again be used in air traffic without restrictions, after the U.S. air traffic monitoring agency FAA withdrew its temporary flight ban for these aircraft when there is danger of icing, reports Avions de Transport Regional (ATR), Toulouse (see BLICK DURCH DIE WIRTSCHAFT on 16 January). At this time more than 400 ATR-model aircraft are in operation worldwide.

Extensive tests over Edwards Air Force Base in California have meanwhile shown that aircraft of type ATR 42 and ATR 72 demonstrate unobjectionable flight behavior even during icing. The French air traffic authority DGAC has also retracted its temporary safety restrictions. The European air traffic authorities, among them the Federal German Air Traffic Office, did not issue a ban on flights at that time.

Such extreme icing tests as were recently carried out in California have not previously been done in aeronautics, ATR further explains. An aircraft loaded with sub-freezing fluid flew ahead of an ATR and sprayed the airfoils of the turboprop aircraft with a layer of ice far beyond actual conditions. The flight behavior before and after this coating turned out to be completely impeccable. ATR also regards this as confirmation of the safety of small aircraft in general.

France To Test Indian Jet Engine

95WS0217A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 3 Feb 95 p 8

[Article: "Indian Jet Engine Tested in France"]

[FBIS Translated Text] The hush-hush negotiations now under way between French and Indian officials are expected to lead to the arrival in France of the "Kaveri" military jet engine, which India is developing for its future LCA warplane. The CEPr (Propulsion Systems Test Center), which is operated by the General Delegation for Armaments (DGA), would conduct tests at its Saclay facility. It should be noted that delays in development of the engine have forced India to renegotiate extension beyond the year 2000 of its F404 rental agreement with General Electric.

India Aims at Global Space Market

BR0203103895 Workingham SP.ICE in English Jan/Feb 95 pp 17-18

[Article by Jon Fairall: "India's Global Aims"]

[FBIS Transcribed Text] India's space industry has reached a watershed. On its own terms, it is mightily successful, but to proceed further, the Indians need to convince the world that they have what it takes to join the major global players. The signs suggest they will be successful.

Over the last three decades Indians have built and flown a series of increasingly sophisticated communication, scientific and remote sensing spacecraft. To Western eyes, it has always seemed a little anomalous: how could a nation of oxcarts and bad water build satellites and fly them?

But to Indian eyes, the space industry has always been a consistent part of the whole. Every development initiative has had to be justified in terms of the contribution it could make to the development of the Indian economy. On this basis, the Indian Space Research Organisation (ISRO) launched its INSAT series of communications satellites to develop the country's communications infrastructure and to provide TV channels and meteorological pictures. It justified its IRS series of remote sensing satellites in terms of improved agriculture and land use. Along the way there

has also been a series of multi-role platforms that have performed a variety of experimental and technology-demonstration roles. To do this, the Indian space industry has built numerous flight vehicles, culminating in the PSLV (Polar Satellite Launch Vehicle) which can place one tonne in a low polar orbit and the GSLV (Geosynchronous Satellite Launch Vehicle) which is currently under construction due to fly in 1997.

But to a certain extent the industry is a victim of its own success. In creating an end-to-end space capacity solely for national needs, the Indians have been forced into creating excess capacity in many areas. Rockets which are flown once every few years, vacuum chambers that get used one month in 12, and so on.

To Dr. K Kasturirangan, the new chairman of the Indian Space Research Organisation and the nation's top space official, it is an opportunity to be grabbed with both hands. "We want to use our excess capacity to develop global capabilities," he says.

Three Strands

There seem to be three strands to India's globalisation ambitions. The most significant is its efforts to enter the world market for geostationary launch vehicles. The recent successful flight of the PSLV points to this. The PSLV is a 280-tonne 44-m, four-stage launch vehicle capable of placing 1,000 kg in a 900-km syn-synchronous orbit. The first stage is a 125-tonne, 2.8-m wide section powered by a solid propellant motor augmented by six strap-on boosters. Above this is a liquid fuel second stage, a solid propellant third stage and a liquid fourth.

The first flight on 30 September 1993 carrying IRS-1E failed to achieve orbit, due to a problem in on-board software. A later flight successfully placed IRS-P2 into orbit.

Development of the GSLV is also proceeding. It is essentially an augmented PSLV. The six strap-on boosters of the PSLV are replaced by four liquid propellant motors derived from the PSLV's second stage. Furthermore, the PSLV's upper two stages are replaced by a single stage with a cryogenic motor. These changes deliver enough thrust to drive 2.5 tonnes into GEO. When it becomes available, around the turn of the century, GSLV will give India a commercially attractive launcher with the right capability to be a major contender for GEO satellite flights.

The second globalisation strand is contained in plans to become a major source of systems engineering expertise. This is already happening. Antrix, ISREI's commercial arm, was one of three organisations around the world that received a request to tender for INMARSAT's advanced third-generation satellites. While it did not win the tender, it led to other studies, including the orbital dynamics of INMARSAT P satellites (which are slated for intermediate orbits) and multiple-frequency antennas (VHF, L and S bands). This contract was won against world competition.

The third strand consists of efforts to sell imagery from the IRS satellites worldwide. There has already been some notable success in this direction. Officials of EUSAT recently concluded an agreement to receive data from the IRS satellite at its Norman Earth station. The agreement

followed the loss of LANDSAT 6. It is especially fortuitous for the Americans, because the LISS instrument on the IRS satellite is almost identical to the MSS instrument on the LANDSATs.

A party of EOSAT officials who attended the 15th Asian Remote Sensing Conference in Bangalore last November told SPACE they were generally happy with the quality of the imagery they were receiving at Norman and that the deal was working well.

In addition, Kasturirangan says, "we are developing relationships with similar organisations to ours in other countries. We have a cooperative agreement with the German, French and European space agencies and I am anxious to revive an agreement we once had with NASA. There are many areas in which we could cooperate. For instance, we could make a significant contribution to NASA's Mission to Planet Earth.

"We already have a significant agreement with the Russians. At one stage, Russia provided us with launches for our satellite programme wither-free, or at friendly rates. Today, their rates are commercial and therefore not very attractive for us. We also have an agreement for them to provide us with cryogenic engines for the GSLV."

These engines soured relations with the U.S. when it was proposed to transfer the technology from Russia to India. Officially, the U.S. was concerned that they could be used for military purposes. Many Indians argue that this was a smokescreen for growing U.S. unease at Indian proficiency.

Today, Kasturirangan says that there is no argument with the U.S. over cryogenics. "Cryogenic motors are of no military significance. They are too difficult to operate for them to be of any use to the Army. Secondly, we have an open programme. The U.S. knew what we wanted the engines for, as does everyone else.

"In any event, it is a general Indian position that we will never be a source of missile proliferation. Whether we will sign a missile non-proliferation treaty with any country is another matter, about which I prefer not to comment. The point is, we do not intend to proliferate for military purposes.

"I don't really understand the U.S. position. They have their own way of looking at things. But I think that maybe they understand our situation a little better now, which is why they raised no objection to our new agreement with Russia." The new agreement provides for the sale of the cryogenic engines themselves, rather than the underlying technology.

Apart from such direct bilateral deals, the other big initiative in the Indian space industry is the creation of Antrix Corp., India's first private space company with the ability to provide end-to-end space services. Antrix was started by Kasturirangan's predecessor, U. R. Rao and is enthusiastically endorsed by Kasturirangan.

"We created Antrix because of operating restrictions on government departments common to all countries with an attitude to civil service inherited from the British. A government department can't make and retain profits like

a private corporation, hire and fire staff and in general behave with the kind of flexibility that is necessary in the commercial sector."

Antrix is not the only commercial relationship into which ISRO has entered. The organisation spends 53 percent of its budget with local industry. It is less clear how this divides up on international lines. Kasturirangan refused to say what percentage of the ISRO budget is spent overseas, but he did say that 60 percent of a typical satellite and 35 percent of a typical launch vehicle budget was spent overseas. He said that, while India had the capability to produce an entire satellite from its own resources, it was often necessary to make purchase decisions in the light of economic reality.

For instance, Indian industry had made considerable progress with microelectronic fabrication techniques, but it is usually not economic to make micro-electronics in India. He does take credit, however, for forcing Indian electronics companies to introduce modern quality control procedures on their assembly lines.

The future directions of India's space industry, according to Kasturirangan, include navigation, mobile communications, improving the technology of satellites, using new wavelengths for remote sensing—such as microwave synthetic aperture radars—oceanic remote sensing for fishing and meteorology, and messaging.

"In mobile communications, our first move will be to create a culture in which (they) can be used as a business tool for long-distance trucking. This will be allied to the use of positioning systems, which will also find applications on the railways. Currently, this is an industry with massive inefficiencies due to the fact that trucks can be away from base for weeks at a time." India is 3,000 km by 3,000 km at its widest, with appalling roads where maximum speed is often 60km/h.

"This does not imply that India will create its own positioning system, or its own mobile communications satellites, but it does imply that India might be prepared to work with other countries to develop either space or ground components of such systems."

Kasturirangan has not been pleased with the first moves in this direction however. He would like to see more ambitious programmes than the first communications agreement between Indian companies and a U.S. one. Lockheed Missiles and Space Company is building a 66-satellite constellation for Iridium. Essentially, the Indian companies are providing substantial equity capital in the project creating gateways to their PSTN. The U.S. is providing the technology and building the satellites. "India could contribute much more than this to the project," says Kasturirangan.

He is also a little dismissive of the early results from radar remote sensing satellites. He says radar systems would cost too much for the possible benefit. "We are not convinced that one can justify the expenditure for what seem like marginal benefits. We have built an airborne SAR to test out some concepts and also conducted tests on ERS-1 data. While it is certainly interesting, it does not seem to add

very much. Nevertheless, we are maintaining a watching brief on the RADARSAT project."

Whether all these plans for closer interaction with the world's space communities will work to India's advantage remains to be seen. But adopting a global outlook is not a luxury for the people at ISRO. India is experiencing the same kind of globalisation and economic rationalisation that has bedeviled space industries throughout the world. As other space administrators have discovered, the real challenge will be to keep the accountants at bay.

Kasturirangan's game plan to secure the future of the 17,000-strong space industry is to become a source of foreign exchange while maintaining the traditional justification for an Indian space industry. It may be a fine balancing act.

Flight Characteristics of Future A3XX Tested in German Flying Simulator

95WS0215A Bonn DIE WELT in German 31 Jan 95 p 7

[Article by Norbert Lossau: "Mini-Jet Simulates Airbus Super Jumbo"; Subhead: "Test Pilots Using Powerful Computers Able to Pilot Through Sky Aircraft Not Even in Existence Yet"]

[FBIS Translated Text] Cologne—In the year 2003 the planned European Super-Jumbo Airbus A3XX is to soar skywards for the first time. This gigantic aircraft will afford seating for as many as 840 passengers and therefore will have nearly twice the capacity of a current Boeing 747.

Even though the Airbus A3XX still exists only on the drawing board, pilots of the German Aerospace Research Institute (DLR) have now already tested the flight characteristics of the projected aircraft—in a flying simulator.

Since 1986, with the Advanced Technologies Testing Aircraft System [ATTAS], the DLR's Institute for Flight Mechanics in Braunschweig has been in possession of an aircraft that is capable of simulating the characteristics of other aircraft. Whereas conventional, ground-based flight simulators, given the current status of the technology, are incapable of conveying to the pilots completely realistic visual and motion conditions, in the ATTAS cockpit it is possible actually to experience the flight characteristics.

Theoretically, at present the behavior of an aircraft can be precisely computed on powerful computers with a cluster of physical regularities. On a flying simulator, however, the flight behavior computed from the control commands of the pilot are imposed on an actually flying craft. It possesses extra control flaps enabling flexible, speedy reaction by the aircraft.

ATTAS is based on the VFW 614 twin-jet regional aircraft on which the turbines are positioned above the airfoils. The performance of this flying simulator is unique for Europe. It was possible using this aircraft realistically to simulate even the flight characteristics of the Hermes space glider, that, in the meantime, as everyone knows, has been slashed.

Whereas the "actual" ATTAS is maneuvered mechanically, the control commands for the aircraft to be simulated are conducted via data cables and beam waveguides

from the cockpit to a cluster of ten leading-edge computers. Sensor and laser gyro data are also inputted there. In real time the computed control commands are transmitted via 15 electrohydraulic control systems.

Only experienced test pilots are allowed to sit in the cockpit of the ATTAS. Unlike a ground-based flight simulator, actual flight in an "unfamiliar" craft is not always risk-free. Seated to the right of the aircraft's pilot is the so-called safety pilot who is able at any time, by pressing on a single button, to switch the control of the plane to normal operation: a super-jumbo then forthwith once again becomes small regional aircraft.

It is hoped that the A3XX "flying simulator" will mean a reduction in development costs, currently projected in any event at an impressive 12 billion marks. The aerodynamic characteristics and the control and systems engineering behavior of the future aircraft, after all, are able in this way to be realistically studied in advance and as a result, specifically optimized—even before so much as a single part for the super-jumbo has been manufactured.

Failure of EXPRESS Satellite Project Seen Delaying German Aerospace R&D

BR2102135795 Amsterdam TECHNISCHE WERKBLAD in Dutch 25 Jan 95 p 6

[Report by Harris Tiddens: "Development of European Aerospace Delayed"]

[FBIS Translated Text] Cologne—The crash of the German-Japanese EXPRESS satellite is a big setback for Japan and Germany in their attempts to develop their own aerospace technology. The small amount of attention that the crash received was unjustified. It was no ordinary communications or observation satellite that was involved. Express stands for "Experiment Reentry Space System," an experiment which is central to the further development of non-American or non-Russian space travel.

The Europeans are certainly in a position to place satellites neatly in orbit, but they are still far from being able to get them back again. In particular, heat shield technology is a secret which is meticulously protected by the Americans and the Russians. This protection is irritating because the technology used by the Americans is somewhat outdated. Ceramic tiles protect the space shuttle from being vaporized like a meteor by the heat of the friction experienced during reentry into the earth's atmosphere. But the tiles are heavy and NASA needs to replace a significant number of them after each landing.

Using the EXPRESS satellite, the German Aerospace Agency (DARA) planned to test its own heat shield, which is lighter and more durable. This part of the experiment was called "CETEX" (ceramic tile experiment). It used a new carbon fiber material which was protected against oxidation by silicon carbide.

The test was intended to demonstrate to what extent this heat shield could be reused. In fact, even the German engineers have not yet been able to prevent the material from beginning to oxidize at temperatures of over 1,600°C. On return into the earth's atmosphere the temperature is

around 2,350°C. It had been hoped to carry out research into how deep the oxidation layer had penetrated into the material. This has all been delayed by the Japanese satellite accident.

Israel: IAI Prepares for AMOS Satellite Launch

BR2802150395 *Workingham SPACE in English*
Jan/Feb 95 pp 19-21

[Article by Mark Williamson: "The AMOS Technology Leap"]

[FBIS Transcribed Text] Israel launched its first satellite, OFFEQ-1, in September 1988. It weighed 155 kg and remained in low Earth orbit for just 16 weeks. This year, Israel hopes to launch its third satellite, AMOS, weighing 960 kg, into geostationary orbit. Israel's technological leap—from expendable, experimental minisat to fully operational, geostationary communications satellite in only seven years and three satellites—provides a lesson in space development that other emerging spacefaring nations may wish to emulate.

The prime contractor and design authority for AMOS is Israel Aircraft Industries (IAI), a major defence and commercial aerospace corporation with an annual turnover of more than \$1.5 billion and an export market covering over 60 countries. IAI began to develop the space systems' side of its business in 1992 when plans were made to design and build OFFEQ. As part of this development programme, the company was obliged to invest in the laboratories, clean rooms and test chambers required for spacecraft production. Recognising its inexperience in the field, IAI sought the assistance of INTESPACE, the European integration and test specialist based in Toulouse. The result was IAI's impressive 3500 sq m spacecraft integration building sited close to Tel Aviv's Ben Gurion Airport.

In 1987, as the launch of OFFEQ-1 approached, IAI began to consider a joint proposal with Fairchild in the U.S. for a larger satellite called AMS (African Mediterranean Satellite); IAI was keen to move from defence to civil applications and the development of a regional communications satellite such as AMS seemed an appropriate route. But like so many satellite proposals, the project was terminated when the partners failed to secure sufficient funding.

Following the launch of the second OFFEQ in April 1990, IAI began to consider the AMOS programme, not as a joint venture with a foreign contractor, but as a solely IAI-controlled programme. Of course, the transition from AMS to AMOS was somewhat more involved than adding a letter O! Since the company wanted to develop the satellite quickly as a commercial project, it needed the support of more established and experienced manufacturers—so contracts were negotiated with TRW in the U.S. and Dornier in Germany.

By the time the AMOS programme was formally begun in January 1992, however, TRW had left the group, so the programme was initiated with subcontractors Dornier and MBB in Germany, and Alcatel Espace in France. AMOS is currently being integrated and tested by IAI in preparation for its forthcoming launch by Ariane.

Design Philosophy

IAI's design philosophy throughout the programme has been to avoid technological innovations and use only flight-proven hardware. The manufacturing programme has been based on the classical "protoflight approach" in which no prototype spacecraft is produced. Instead the qualification heritage of previously flown equipment is used to "space qualify" the satellite.

What this meant for AMOS was that no engineering model (EM) or qualification model was built in addition to the actual flight model (FM). The FM will, of course, be thoroughly tested, but not to the same extremes as a typical EM would be. A further limitation in the AMOS programme, brought about by a dearth of funds, is the lack of a second FM or an EM that could be converted to a flight model if the first one should fail. According to Amitsur Rosenfeld, Programme Manager for AMOS, Arianespace executives had never met anyone who adhered so closely to the dictionary definition of the protoflight approach.

Technology

So what level of technology has Israel achieved in its development of AMOS? In essence, the satellite is in the same class as the early 1980's vintage European Communications Satellite (ECS), or EUTELSAT; it is around the same size and mass and generates a similar level of power. The difference is that AMOS has been designed and built in the 1990s and benefits from modern platform and payload technology.

AMOS is a three-axis stabilised spacecraft with a pair of two-panel solar arrays with a total span of 10.5 m when fully deployed. It is defined by IAI as a "lightweight satellite" (less than 1000 kg at launch) and like satellites from other manufacturers, is designed to be "adaptable." In other words, the platform is intended to be a standard item to which a multitude of different payloads can be matched, a philosophy reflected in the satellite's somewhat utilitarian acronym: Affordable Modular Optimised Satellite. According to Amitsur Rosenfeld, IAI had no desire to compete directly with larger, established satellite manufacturers in developing a standard "bus," which is why it chose to size the satellite the way it did. It is evident, however, that IAI would be more than happy for AMOS-1 to be the first of many "AMOS-class satellites" in a size-class that is becoming increasingly popular.

As prime contractor for AMOS, IAI is responsible for systems engineering, integration and test, launch operations, in-orbit tests and operation throughout the satellite's 10-year life. In addition, the company has provided the structure, attitude control, thermal control and TC&R subsystems, as well as the ground station. DBA (in the former guise of Dornier and MBB) provides the power and propulsion subsystems, while Alcatel Espace is payload prime contractor.

The payload consists of seven Ku-band (11/14 GHz) transponders, with two spares, and a single deployable reflector which forms three spotbeams covering Israel, Eastern Europe (centered on Hungary) and Portugal. By

means of an onboard switch matrix, the output from the seven transponders can be routed to the three beams in a flexible manner.

According to Rosenfeld, the nominal design configuration calls for between three and six of the seven transponders to cover Israel, and between one and four to be shared between the other two beams with only two of the three beams operational at a given time. The decision on how many channels are apportioned will depend on future transponder leasing and other business developments.

The technology incorporated within the payload is up-to-date but also tried-and-tested in response to IAI's desire to minimize risk in the construction of its first geostationary satellite. The transponder's 34 W travelling wave tube amplifiers are flight-proven items which operate at a very respectable 60-percent efficiency, delivering an EIRP of 52-54 dBW. The tubes themselves are made by AEG and the electronic power conditioners by ANT. The 1.73m diameter deployable antenna supplied by DBA, like the rest of Alcatel's payload, is based on well-understood design solutions.

The major subsystem equipment is also blessed with a respectable design heritage. For example, the liquid apogee engine (which uses the bipropellants MMH and N₂O₄) is the same type as that flown on EUTELSAT II, while the 25-cell, 50 Ah nickel hydrogen battery is similar to those flown on recent INTELSAT and Superbird spacecraft.

So when will AMOS be launched? At the moment the answer is unclear. The Ariane manifest for October 1994 showed AMOS sharing V77 with PanAmSat's PAS-4 in May 1995, but the launch date could slip because of revisions to the payload requested by the Israeli government. In addition, Ariane's recent failure has cast doubt on the 1995 schedule, increasing uncertainty.

The government has asked for the beam covering Israel to be widened by some 25 percent. This would mean changing the relevant feedhorn and retesting the antenna subsystem, which according to Rosenfeld would cost about \$7 million and delay the launch by three or four months. Understandably, IAI would like the government to reimburse its costs for the change and this was still being negotiated at the time of writing.

Finance

As with most projects, finance is a key factor. According to Rosenfeld, the total costs of the AMOS programme amount to some \$275 million, including the satellite, ground station, launch, insurance and the costs involved in operating the spacecraft for its ten-year life. It also includes the interest payments on \$100 million in loans from Israeli banks, which are guaranteed by the Israeli government. The company has also arranged credit lines in Europe to pay its European subcontractors (70 percent before launch and the rest after).

Although the government did not sign a contract with IAI to build the satellite, it committed itself to leasing three transponders for the 10-year mission life to replace the three it currently leases from Intelsat. The fact that the government did not pay for AMOS is indicative of its general policy towards space development. In much the

same way as the UK government, it is of the firm opinion that industry should support itself.

Indeed, Israel's space industry spends far more than the government on space. According to the chairman of the Israel Space Agency [ISA], Professor Yuval Neeman, the total overall expenditure of the government-funded ISA is about \$50 million (which compares poorly with the \$275 million spent on the AMOS programme). Speaking at the 45th Congress of the International Astronautical Federation in Jerusalem, Professor Neeman explained that the ISA is simply the steering body with a budget of "only five to seven-or-eight million dollars" for direct costs and a limited amount for research and development programmes. According to Professor Neeman, ISA's director general does not even receive a salary!

Services

Long gone are the days when satellites were designed specifically for trunk telecommunications or for direct TV broadcasting; AMOS, in common with the majority of modern-day satellites, can accommodate almost any communications application.

The company formed to market the satellite's services throughout the Middle East is Spacecom Satellite Communications Services Ltd. The company is a partnership involving IAI, Gilat Communications Engineering (a designer of turnkey domestic and international communications networks); General Satellite Services Co (the company awarded the Israeli government's concession for building and launching the satellite); and Mer Services Group Ltd. (an electronics and communications company).

According to Spacecom's Chief Operations Officer, Noam Fink, AMOS will provide domestic and regional communications and broadcasting services to a footprint covering 750,000 sq km and some 250 million people, most of them Arabic speakers. These services will include direct-to-home (DTH) broadcasting (into 50-60 cm dishes), TV distribution to cable head ends, satellite news gathering (SNG), data communications to very small aperture terminal (VSAT) networks, and back-up services for terrestrial trunk telephony.

In addition to the business and commercial applications such as VSAT and videoconferencing, Spacecom is keen to highlight the less glitzy uses, such as rural communications and remote education. In effect, AMOS promises the sort of range of services that other emerging satellite nations promote. Though AMOS does not carry an Earth observation payload, the parallels with India's Insat satellites are easy to see.

For DTH services the AMOS transponders are capable of handling single or dual analogue channels, compressed digital video or, in the future, high definition television (HDTV). According to Amitzur Rosenfeld, the transponders' 72 MHz band-width could accommodate eight to ten digital TV channels. On a practical note, however, he believes that TV transmissions are likely to be analogue-only in the lifetime of AMOS.

Customers will be able to lease a full 72MHz transponder or 9 MHz segments for anything between ten years and a

few hours, depending on requirements. According to Noam Fink, two and a half transponders have already been reserved, two by the Israel Broadcasting Authority (for TV transmission) and 0.5 for VSAT applications, including distance learning. Fink expects eventual revenue to be split between TV and VSAT on a 70-80 percent/20-30 percent basis. Other customers are expected to include communications agencies, private corporations and the Israeli government itself.

As for customers outside Israel, the possibility of business links is inevitably tied to politics. According to Noam Fink, Spacecom will look for business in Egypt, with whom Israel already has a peace treaty, and with other Arab nations if political negotiations allow. The situation for Jordan, Bahrain and Kuwait "looks promising for future services," he said.

According to Spacecom's publicity, the launch of AMOS will occur "several months or years before other satellites dedicated to serving the Middle East." Asked about competition in the region from the long-established ARABSAT organisation, Fink was optimistic. At present, ARABSAT has only C-band capacity in orbit on its first generation satellites. Although the second generation will add Ku-band (the frequency band at which AMOS will operate), the satellites will not reach orbit until 1996/97, by which time Spacecom hopes AMOS will be established. Fink also mentioned the possibility of competition from an Egyptian satellite, dubbed NILESAT, but since a contract for its design and manufacture has still to be negotiated, it is not seen as a near-term threat.

The Future

The lack of a back-up satellite, to cover the possibility of a launch or in-orbit failure of AMOS, must worry some potential users. The shortage of government or private finance makes the provision of a back-up impossible, however. Although IAI makes light of the deficiency, it has been pursuing an innovative option which could provide an in-orbit spare for AMOS and earn the company some money. For some time the company has been discussing a

follow-on to AMOS called CECS (Central European Communications Satellite) with a customer in Hungary. The owner of the satellite would be the Hungarian company Magyarsat and the service provider would be Antenna Hungary. According to Rosenfeld, IAI had hoped to sign a contract in the second quarter of 1994, but elections in Hungary "intervened."

The proposed satellite is heavily based on AMOS and would be co-located at 4 deg W to provide the same coverage via an Israel beam and a Europe beam. So the prospective deal with Magyarsat would provide a back-up to AMOS, while AMOS would provide a back-up to CECS; the mutuality of the arrangement is underscored by the fact that CECS is sometimes referred to as AMOS-2.

IAI hopes to sign the contract for CECS early this year and expects a 28-30-month development programme for the satellite. Looking further forward, IAI is also pursuing business contacts in the Czech and Slovak republics, Poland and Romania. This implies that its business plan involves emerging European nations that established spacecraft manufacturers have largely overlooked. If IAI is successful it could develop a niche market for this size of satellite in Europe and elsewhere.

Beyond the confines of the satellite business, IAI has been trying to sell its Shavit small satellite launch vehicle in the U.S. as an "inexpensive launcher of university and other research payloads" between 100 and 200 kg. Its attempts have so far been blocked by the U.S. government's concerns over missile proliferation, but IAI is hopeful that improving peace prospects in Israel will assist the development of its space business. Considering the odds stacked against it, IAI has not done too badly so far.

In a period of space history when the major players were paring budgets, cutting programmes and generally battling against recessionary forces, Israel has been working quietly on developing a niche in the already crowded satellite communications business. The result, a respectable foothold in the space technology scramble and the potential for future business in the communications services sector, is an example of what can be done when sufficient drive and determination is present.

German Research Ministry Funds Project for Electric Vehicle Lithium Battery

MI2302101595 Bonn *TECHNOLOGIE-NACHRICHTEN*
MANAGEMENT-INFORMATIONEN in German
29 Dec 94 p 2

[FBIS Translated Text] The Federal Ministry for Education, Science, Research, and Technology (BMBWF) has approved the funding of an extensive joint project for the development of a lithium battery system for electric vehicles. A sum of 14 million German marks has been provided as part of the subsidy program known as "New Materials for Key Technologies of the Twenty First Century (MaTech)." The project, scheduled to run over four years, will be carried out by well known German battery producers and research institutes (i.a. Varta Batteries AG, BASF AG, Daimler Benz AG, Center for Solar Energy and Hydrogen Technology Ltd.) and its progress followed closely by the German automotive industry.

The main objectives of the research and development work are a higher power density and longer life than previous battery systems; as a result, traveling with electric cars can become cheaper in the future. The goal is to achieve a short charging time and low self-discharge. Traveling will

become more environment-friendly due to the use of more environmentally acceptable materials.

Apart from the lithium battery, there are also plans to use a lithium-based supercapacitor in order to increase the peak performance and acceleration reserves of the vehicle.

Due to the combination of the two systems (battery and supercapacitor), the efficiency data of the vehicles developed specially for battery operation can be improved considerably. Thanks to the rapid storage of braking energy in the supercapacitor, the number of battery charging cycles required is reduced and the life of the lithium battery is increased. The technical and vehicle-related safety requirements of the automobile industry in respect of the energy storage will be taken into account from the outset when the traction battery is developed. To complete the first phase of the materials research work that has just begun, there are plans, after a certain delay, to carry out complementary system work on battery management and the energy storage/electric drive interface, and to test the system at a later date in a fleet vehicle test.

Further information can be obtained from Dr. Peter Krautwasser, Project leader, Material and Raw Materials Research (PLR), Juelich Research Center, Postfach 1913, 52425 Juelich, Tel. 02461/61-4897, Fax 02461/61-2398.

More EU Funds for Biotechnology Research

MI2102140095 Milan IL SOLE-24 ORE in Italian
7 Feb 95 p 5

[Article by Anna Borioni: "European Union To Pay Greater Attention to Biotechnology—An Appropriation of 552 Million ECU's for Research in This Sector During the 1994-1998 Period"]

[FBIS Translated Text] The fourth research plan, launched by the European Commission for the period 1994-1998, describes the principal characteristics of the funding program for biotechnology; these being more financial resources, new ways of developing projects, and greater attention to the participation of small- to medium-sized industries and to applied research. The new opportunities, that are being offered to companies and research groups in this ambit, were recently described at a meeting that was organized by the CNR [National Research Council] in Rome. During this meeting it was made very clear that the European Union is expecting very significant results from this sector. "We want European biotechnological research to make a jump in quality, and on a decisive scale," explained Etien Magnien, who is responsible for the management of the program in Brussels. "Our goal is to create a critical mass of research, and of groups of researchers, able to compete with the USA."

In order to attain this ambitious result, 552 million ECU's have been made available, to be spent over five years. This appropriation is almost quadruple the 149 million ECU's, that was the budget that it had the benefit of for the preceding five years. The community has stipulated that these funds should serve principally to overcome the weak points in European research today, both in structural terms and in terms of knowledge. Consequently, the program has been drawn up following three strategies, the most important of which has the goal of producing a "concentration of resources," and two thirds of the entire budget have been set aside for this. The projects that will be funded in this way are those that are destined to significantly modify the knowledge we have today in four fundamental sectors: cell production, the analysis of the genome, animal and vegetable biotechnology, and cellular communications in the neurological sciences. The typical project that the community would like to see in this area is a multidisciplinary project that groups together a large number of industrial and university research groups, of the order of 30-40 participants.

A new and different operative basis has been introduced through the mechanisms for the "concentration of resources." These have the goal of encouraging national research programs to link up, so as to valorize the potential for innovative discovery in some key sectors that tend to remain isolated in the single member states. Once again four sectors are concerned: immunology and vaccination, structural biology, the field that links the prenormative research, biological diversity and social acceptance (norms and methods for evaluating acceptable risks), and infrastructures (the European bases for biological computer services). The community does not participate in research funding for this type of project, but only refunds the expenses incurred by the coordination activities.

Finally, all the scientific and technological sectors are open for the entire range of the "horizontal activities," destined to link the results of the research to social expectations. There are two important new things: the "demonstration projects," in which the producers of technology and its users will jointly participate, and that will have the job of demonstrating the technical feasibility of the new technologies and the relative economic advantages, and the "awards during the preliminary stages of the projects," that are intended to facilitate both the preparation of the demonstration projects, and the participation of small- to medium-sized companies. The maximum awards are of 45,000 ECU's and are paid for proposals that are already definitive in the first case, while for the small- to medium-sized companies the contribution can also be allocated when only an outline proposal is presented. In this way the community hopes to provide an incentive that will encourage the participation of the small- to medium-sized companies, that in the preceding program represented only 6 percent (equal to 52, eight of which were Italian) of the 856 European companies that participated in the 99 research contracts that were drawn up for biotechnology. However, attention! The closing date for replies to the first announcement is near. The proposals must reach the Commission by 12:00 a.m. on 27 March, so there is no time to waste.

Germany: Biotech Firms Suffer from Lack of Venture Capital

95WS0170B Duesseldorf HANDELSBLATT in German
24 Jan 95 p 7

[Article by Iok: "Biotechnologies and the Trouble with the Market," under the rubric: "Research: Banks Do Not Like To Give Venture Capital"]

[FBIS Translated Text] Germans are insignificant in the growth branch of biotechnology. The Japanese and U.S. Americans are in the lead, even in Germany. Industry often reacts with rejection to inventors. Consequently, production at their own expense remains the only recourse for most inventors.

Ursula Erhardt had an idea. She combined two long-known methods of biochemistry and used the advantages of both processes. Instead of having to wait hours for a test result, today a doctor can determine the vaccination or immunity status of a person in a few minutes. Erhardt patented her idea and made contact with the large pharmaceutical companies. While these companies were curious, they were not prepared to invest.

The chemist developed the tests for medical laboratories herself. Together with her husband, Christoph Erhardt, and the businessman, Kurt Maier, she also founded the company Abion in 1990. She was successful—despite the skepticism of the large pharmaceutical companies. In 1993, she received the Philip Morris Research Prize that comes with 50,000 German marks [DM]. Today, the company has 30 employees in Juelich.

Many inventors in biotechnology tell the same story as Ursula Erhardt. They have marketable ideas but only seldom do the established pharmaceutical or chemical companies show an interest in them. They frequently

seek, without success, venture capital with which they could make themselves self-sufficient. The banks require securities; investors with the necessary courage and capital are rare. The situation in the U.S. is completely different. There, biotech companies mobilized almost \$5 billion in the boom year of 1991 (HANDELSBLATT, 1 December 1994).

It is no wonder therefore that biotechnology in Germany is limping behind. The applications at the German Patent Office impressively confirm this situation. In 1993, just 177 persons from Germany applied for patent protection for their invention in biotechnology. U.S. Americans, on the other hand, made 1,172 patent applications and the Japanese even made 1,977.

Biotechnology is seen as one of the most important fields of the future. The world market for biotechnology products should be DM 170 billion in 2000, according to an estimate of the Senior Advisory Group on Biotechnology from Brussels. Besides the pharmaceutical concerns, more and more researchers and scientists in Germany are trying to get a piece of this pie. Despite all the resistance and the smothering competition, they are looking for their niche.

One of these pioneers is Walter Roewekamp. He is the managing director of Angewandte Gentechnologie Systeme [Applied Genetic Technology Systems] (Ags) GmbH in Heidelberg. Following years in basic research, he founded his own company. He wanted to produce and sell tools for genetic technology—to be more precise, the enzymes that can cut and reattach genetic material.

As German companies active in this area showed no interest in a joint venture, Roewekamp started his own company in 1988. He used his own money, funds from a support program of the Federal Research Ministry (BMFT) and the Land of Baden-Württemberg, as well as loans. Roewekamp could still expect financial aid during the development of the products. During development to market readiness, he was on his own.

He was able to get more money from the BMFT for additional research and a new loan, but then his bank did not want to get in deeper. Finally, Roewekamp found another bank that was ready to take over his loans exceeding DM 2.5 million. Besides selling his own products, the biotechnologist is building up a second pillar, i.e., the sales of accessories. He then turned the corner in April 1993.

Similar experiences were made by Elmar Michels. He is the founder of cell diagnostica GmbH in Münster. He also reports problems with banks. "I had a lot of trouble convincing the banks of my concept. Their experience in the area of biotechnology, especially here in the Westphalian provinces—not very extensive." The banks could only poorly estimate the chances of success for founding a company in this area. Even their technical consultants could not provide much help. "The banking institutions do not have a feel for when interim financing is necessary and promises success," judges Michels.

There is also a lack of independent consultants who know their way around the jungle of financing and support possibilities. Says Michels, "The Chamber of Commerce

in Münster was out of its depth." The entrepreneur entered a difficult phase after two years, once the product was developed and he wanted to start series production. In this phase, the bank became very nervous, remembers Michels.

Today, not only does he produce his own tests that are used to diagnose tumors, among other purposes. He also does research under contract to the major players in the branch. For their part, they have taken over sales of his products.

The marketing chief of Abion GmbH, Kurt Maier, views this solution with skepticism. "If you completely give up sales, you assume a risk. It may happen that his product will never appear on the market." Maier recommends therefore to all company founders that they build up their own sales organization during the development of the products.

However, many scientists from biology or biochemistry do not even risk the step into their own companies. The university and industry are still worlds apart. Researchers in the laboratory could only rarely estimate what companies can convert into a marketable product.

Even if a company has purchased an idea, its conversion is not guaranteed. "Companies suffer from the 'not-invented-here' syndrome. If their researchers purchase a patent, they must first justify to themselves internally why they did not develop it themselves. Consequently, the invention is run down quickly," reports Professor Leopold Flohe. Flohe has worked for years in industry and today is the scientific business manager of the Biotechnology Research Company (GBF). This is a large state-financed research institute in Brunswick.

There is another problem. The universities are not flexible enough, in the opinion of Flohe. Consequently, professors are civil servants with tenure, something that does not absolutely increase creativity, runs his criticism. "It would be worthwhile to exchange employees between industry and the universities on all levels. In Germany, this exists only for young scientists. In the U.S., a professor can become a boss in industry at 40 and vice versa."

However, no one should underestimate the mentality differences between companies and researchers in Germany. "In science, you work for publications in respected technical journals. A long list of articles is the prerequisite for a career." It is different in the world of industry. "In a company, you work for products. There, products that sell well are indispensable for a career."

In the U.S., on the other hand, the inhibition threshold is lower. "If a company with a problem in the States turns to a toxicologist or pharmacist at a university, after two weeks they will have worked out a concept for a solution. This will include all test reports and quality controls needed by the company to receive the government permits necessary later."

Flohe wants to have this style catch on in his laboratory. "We want to use the rules and regulations valid in industry for us, too. A company can then use the results faster."

However, this means 50 percent more routine work for the laboratory. "And this does not sit well with creativity and it costs money," says Flohe.

Italy: R&D on Human Genome at TIGEM Lab in Milan

MI2102135995 Milan IL SOLE-24 ORE in Italian 31 Jan 95 p 9

[Article by Giovanni Padovani: "The Search for the Human Genome at TIGEM in Milan—The Laboratory at San Raffaele Scientific Institute Funded by Thelethon"]

[FBIS Translated Text] The search for genes, to investigate the structure of DNA [deoxyribonucleic acid] and its associations with illness, is producing ever more surprising results throughout the world, and in Italy too. Andrea Ballabio, scientific director of the TIGEM [Thelethon Institute of Genetics and Medicine], the genetic research laboratory funded by Thelethon-Italia at San Raffaele Scientific Institute in Milan, sustains that "250 genes a year are now being identified."

A few more than 5,000 genes are known at present, and about a thousand are those linked to single pathologies. However the rhythm of discoveries, a veritable rain of data that submerges the editors of the specialized scientific magazines every week, is getting faster and faster, and it is reasonable to forecast that by the year 2020 the positions of all the 100,000 genes that make up DNA will have been located. Genes are the smallest working units of our biological patrimony. Each of them has the job of "coding" a single protein, that is often essential for life. The gene hunt is considered to be one of the most promising frontiers of molecular biology, and of all basic medical research today, precisely because of the number of results obtained, and that forecast for the future.

"When all the genes have been located, and when we have also understood their functions," affirms Alberto Mantovani of the Mario Negri Institute in Milan, "we will be able to say that we have read all the sections of the biological code, even if we shall still have to understand the global organization of DNA and its aggregate functioning, and this is no small thing." The Mantovani team has obtained more than one success in the genetic investigation of the immunity system and, in 1990, it discovered the gene that codes interleukin, one of the leader substances of the inflammatory processes.

The gene hunters use more than one method. Elena Rugari of the TIGEM explains that: "If the protein that is involved in the illness is known, it is fairly easy to work back to the single gene. However, if the protein is not known, as is more often the case, it is necessary to make use of the few genetic imprints, like the so-called markers, that it is possible to find in individual patients. It is like looking for a needle in a hay stack. First it is necessary to identify the chromosome, and then the area of the chromosome in which the marker is present. Sometimes it takes years to find a single gene. Ever more frequently, however, the knowledge that has been acquired facilitates a third type of approach, that of the candidate gene. This can be used when a series of indirect pieces of information relative to the illness lead immediately toward a gene."

Finally the possibility of mapping genes, independently of how much we know about their protein expressions and their association with illnesses, must not be forgotten. This is the method of the so-called Genome Project, an international study that started in 1988, and has assigned the investigation of various chromosomes to various nations (Italy was given the X chromosome). The research into illness-genes is proceeding in parallel.

As far as the situation in our country is concerned, genetic research is one of the sectors where Italian has always been a scientific language too. The presence of schools that have recognized international value—such as those of Pavia, Naples, and Turin—has produced results of great value. For example, last September the NEW YORK TIMES dedicated half a page to the discovery of one of the genes that decides whether each new human being will be male or female. This gene has been named DSS and was located by Giovanna Camerino's group from Pavia University. "As far as the genetics school of this city is concerned—observes Marco Fraccaro, lecturer in genetic medicine at Pavia—the origins of its excellence date back to the immediate post-war period, when Buzzati Traverso started studies of this type, taking them immediately to an international level. It must not be forgotten that Luca Cavalli Sforza, who is today a professor at Stanford and the author of the monumental "History and Geography of Human Genes," that has just been printed at Princeton, also comes from the Pavia school."

Finally, since 1990, the commitment of Thelethon, the private organization that has the goal of promoting research into hereditary illness, has given a new, providential impulse to genetic studies in Italy, that have also been afflicted by grave economic limitations. In four years, using the money collected during the annual television marathon, 372 research projects have been funded, and the TIGEM, the genetic and medical research institute for which Thelethon has exclusive economic responsibility, has been functioning since the beginning of the year.

The TIGEM is the most important genetic research group in Italy today and one of the most important in Europe, judged on the basis of the number of people working there (40 researchers and technicians) and its funding (a budget of 11 billion lire for the next three years).

Hungary: Molecular Genetics Research Center Presented

BR2802110095 (Internet) gopher.abc.hu in English Feb 95

[Unattributed report: "Agricultural Biotechnology Center: Institute for Molecular Genetics"]

[FBIS Transcribed Text]

Staff

Director: Prof. Orosz, Laszlo D.Sc. biology, genetics.
Deputy director: Olasz, Ferenc Ph.D. genetics, mol.biol

Secretary: Balatoni, Gabriella.

Senior scientists: Dallmann, Geza Ph.D. genetics, mol. biology; Dallmann, Klara Ph.D. genetics, biochemistry; Prof. Horvath, Laszlo Ph.D. biology (partial); Orban,

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Laszlo Ph.D. biochemistry, comp. physiology; Szajani, Bela Ph.D. biochemistry (partial); Varga, Laszlo Ph.D. animal breeding.

Visiting scientists: Prof. Andreas, Chrambach Ph.D. (1992, June); Prof. Boaz, Moar Ph.D. (1993, Sept.); Darren, Williams (1993 April-May); Karsai, Ildiko (1992); Mark, Garner Ph.D. (1993, October); Prof. Norman, Mclean Ph.D. (1992, May, 1993, May.); Saghy, Tibor DVM (continuously 1991-); Hajos, Marta Ph.D (1992-)

Ph.D. students: Adam, Attila M.Sc. biology; Bakos, Agnes M.Sc. biology; Erdelyi, Ferenc M.Sc. biology; Elo, Peter M.Sc. biology; Farkas, Tibor M.Sc. biology; Kiss, Janos M.Sc. biology; Lele, Zsolt M.Sc. biology; Lados, Miklos Ph.D. biol.eng.; Muller, Ferenc M.Sc. biology; Nagy, Tibor M. Sc. biology; Papp, Istvan M.Sc. biology/chemistry; Papp, Tibor M.Sc. agr. eng.; Szeverenyi, Ildiko M.Sc. biology/chemistry; Vibok Ildiko M.Sc. biology.

Undergraduate students: Bibo, Marton Bodoky, Tamas Borsics, Tamas Buzas, Edit Csapo, Zsolt Csiszovszki, Zsolt Kern, Andras Mihalik, Balazs Semsey, Szabolcs Stetak, Attila Vajna, Istvan Wunderlich, Livius.

Technical staff: Egedi, Sandor; Bartos, Balazs; Burin, Jozsef; Kiraly, Lilla; Kis, Szilvia; Kotsis, Zsuzsanna; Maszlag, Edit; Nagy, Andrea; Nagy, Agota; Santa, Csilla; Sovari, Krisztina; Tozsa, Irma; Toth, Magdolna;

Goals

The Institute for Molecular Genetics (IMG; phone: (36)-28-330-041; fax: (36)-28-330-416) is a subdivision of the Godollo-based Agricultural Biotechnology Center [ABC]. Its staff was recruited mainly from the "Szeged genetic school" characterized by a profound and balanced theoretical background in classical and molecular genetics coupled with laboratory skills in the recombinant DNA technologies. The roots of the scientific projects go back 3 to 5 years.

The "unit" in IMG is the highly autonomous small group of 2-5 researchers (including graduate students), organized around the chief projects. In addition, undergraduate students, postgraduates, visiting associates and cooperating scientists join each group.

In the scientific program of IMG, basic research and high-technology applied research are about half and half. The starting projects are assembled around two "academic axes" (transcription regulation and transposition) and are arrayed in four more applied goals (gene regulation in plants; transgenic fish; comparative genetic mapping with molecular markers; amino acid fermentations of fodder quality).

Intensive scientific cooperation with groups in the other ABC institutes, with groups at University departments (at Godollo Agricultural University; Eotvos University, Budapest), at Agricultural Institutes for Development (Animal Breeding, Herceghalom; Fish Breeding, Szarvas) have been established. An intensive exchange of scientific results and cooperation with leading Laboratories, especially at Biozentrum Basel (Switzerland) and at the National Institutes of Health (Bethesda, MD, U.S.) have been developed. Research grants have been obtained on a

competitive basis from the Hungarian Science Foundation (OTKA), from the National Committee for Technological Development (OMFB), from ICGEB (UNIDO), from the NIH (U.S.), and from the Foundation for development in Higher Education (FEFA).

The Institute takes its share of higher education with lecture courses in genetics and molecular biology by accommodating and supervising the research work of graduate (M.Sc. and Ph.D.) students. Senior members of the Institute are leading teachers in 3 Ph.D. programs at Godollo University, and in 1 Ph.D. program at Eotvos Lorand Science University.

Genetic Regulation

Project on the structure of the C repressor of *Rhizobium meliloti* phage 16-3

Project leader: Orosz, Laszlo D.Sc.

Member: Dallmann, Geza Ph.D.

Our results prove that the *Rhizobium* phage 16-3 C repressor folds into domains. One of the operator-binding domains can autonomously regulate on of the 16-3 operators, OR. The results of three experiments have supported this conclusion.

(i) Repressors whose carboxyl-terminal regions had been deleted repressed OR *in vivo*. The most severely truncated active variant lost 60 percent of the 197 amino acid C repressor. This repressor, R1-77, retains only the first 77 amino acids of the intact protein. (For these studies, we constructed an appropriate reporter plasmid system, in which the effect operator and repressor alleles, their combinations, can be characterized quantitatively. It is worth mentioning that these repressors were probably not over-expressed, since the truncated repressor genes were cloned on low-copy-number plasmids).

(ii) A fusion protein R1-77-a-gal binds to the OR operator *in vitro*. (We constructed a fusion gene, which in *E. coli* directed the synthesis of a protein having the R1-77 repressor at its amino terminal region fused to a-galactosidase residues 8-1021. Two alleles of this fusion gene were constructed: one with the wild type R1-77 region and one with the temperature-sensitive mutant allele of the same region. The DNA binding abilities of the hybrid proteins were investigated by gel retardation assays, using wildtype and mutant operator DNAs).

(iii) Mutations in the amino-terminal domain affected the ability of the repressor to block the reporter gene expression from PR, while a mutation mapping outside this region, in the carboxyl terminal half of the protein, did not. There were two sources of mutant alleles: from temperature-sensitive—i.e. missense—mutants, and from *in vitro* made mutations—which were transferred to the 16-3 chromosome, and their phenotypic effects tested in the resulting phage mutant - "reversed genetics". The technique to transfer an allele—made *in vitro* in *E. coli*—to a *Rhizobium* specific phage 16-3, and to regain the mutant specimen, was developed in our laboratory.

Supporting grants from: OTKA, Hung.Acad.Sci. T/t and UNIDO-ICGEB to Orosz, Laszlo

Regulation at Different Operators (16-3 Repressor and Operators)

Members: Dallmann, Geza. Ph.D. (partial); Elo, Peter M.Sc.; Nagy, Tibor M.Sc.; and Bereczky, Zsolt; Vajna, Istvan; Kern, Andras; Mark Garner Ph.D. (guests).

This project is part of an ongoing collaboration between laboratories in ABC IBP Godollo (Pongor, Sandor Patthy, Andras Buzas, Zsuzsanna; in ICGEB, Trieste (Pongor, Sandor), and in NIH, Bethesda (Sankar Adhya, Andreas Chrambach, Mark Garner).

Although the loss of the carboxyl terminal region of the repressor still allows binding at one of the operators OR, it inhibits lysogeny. Hence, we concluded that the carboxyl terminal region plays an indispensable role in other significant processes required for gene control. Our current investigations of the function of the leftward operator OL are aimed at elucidating this role. Results to date show that the operator OL is shorter by 2 base pairs than operator OR. This finding may raise a question of more general importance, namely: how the conformation of protein and DNA can accommodate to spacial and rotational differences in sequence specific binding to DNA (16-3 C repressor and operator).

Experimental systems (in vivo as well as in vitro) have been developed to get access to this problem:

- (i) Plasmids (integrative/replicative in *Rhizobium*) containing LacZ fused to controlling elements (operators and promoters) of 16-3 have been constructed. Relative dissociation constants (Kd) for OL and OR operators vs repressor alleles have been measured, along with cooperativity (DNA looping) between the two sites. OR binded stronger than OL, and dramatic cooperativity was registered. Mutational analysis of the operators is also under way.
- (ii) For in vitro studies, the 16-3 repressor protein was isolated and purified (to homogeneity, tac promoter and pKS plasmid backbone were utilized, 50 percent of the protein was repressor). The repressor is extremely basic (pI.9.4), and is active in band shift assays (with OR DNA).
- (iii) Plasmids carrying operators OR and OL were constructed in order to assay phase and distance sensitivity of OR/OL cooperativity (i.e. DNA looping, the sites are separated by 11.2, 11.6, 12, 12.4 helical turns, and up to a few kb in BDNA); and to investigate repressor footprints on DNA.

Supporting grants from: OTKA, UNIDO-ICGEB, FEFA to Orosz, Laszlo

Site-Specific Recombination

Members: Papp, Istvan M.Sc.; Semsey, Szabolcs; Buzas, Edit; Olsasz, Ferenc Ph.D. (partial); Dallmann, Geza Ph.D. (partial)

The main goal of our work was to learn more about the site specific recombination system of the 16-3 bacteriophage of *Rhizobium meliloti* (Rm41).

This system is responsible for the integration and excision of the bacteriophage into and out of the host genome.

Specific enzymes (recombinases) carry out the strand exchange reaction at short target sequences (attachment sites) on the DNA of the bacteria and phages. The primary sequences of the attachment sites of this system were determined. It is worth noting that the bacterial attachment site overlaps a proline tRNA gene.

It seemed possible that we could find some more tRNA or rRNA genes in the vicinity of this putative tRNA gene. We have revealed no other tRNA or rRNA genes, so it seems plausible that this putative gene represents a single unit.

We are determining whether or not two bacterial attachment sites can participate in a strand exchange reaction. If so, this system is a good candidate for being a "minimal system," which requires only the integrase gene to make it functionally active.

We have begun to narrow the possible functional limits of the recombinase gene (it has been mapped on a 4 kb region so far). This is being achieved by subcloning appropriate restriction fragments of phage origin, introducing them back into *Rhizobium*, and probing functionality.

We are also attempting to answer the question whether the putative tRNA gene overlapping the bacterial attachment site is essential for the bacterium. In order to elucidate this, we have constructed plasmids with this site deleted, and currently we are trying to transfer this modified locus back to the chromosome. If the bacteria which carry this deletion on their chromosomes are viable, this gene is not essential. The observation may show evolutionary significance: the 16-3 int/att system (in *Rhizobium*, gram negative) is 85 percent homologous to that of integration plasmid pSAM (in *Actinomyces*, gram positive).

I. Papp also joined the program (led by I. Fodor D.Sc., ABC, IBP) aiming to build a system by which one can easily and efficiently manipulate an eucaryotic (vaccinia) virus by site specific recombination.

Supporting grants from: OTKA, UNIDO-ICGEB to OROSZ, Laszlo and OTKA to PAPP, I.

Constructing Bacterium Strains for Overproducing Amino Acids

Members: Dallmann, Klara Ph.D.; Csiszovszki, Zsolt; Dallmann, Geza Ph.D. (partial); Szajani, Bela Ph.D. (partial)

The goal of this project is to utilize and to convert industrial and agricultural by-products (for example molasses, indole etc) into amino acids of fodder quality. We are focusing first on the tryptophan fermentation by utilizing the indole surplus (free of contaminating carcinogenic materials) of the chemical industry. We have established the conditions for the electroporation for *Corynebacterium* strains. We have made different trp mutant strains both in the genera *Corynebacterium* and *Brevibacterium*. To improve the capacity of exogenic indol conversion to tryptophan in different bacterial strains, we have cloned trp AB genes from *E. coli* and fused to promoters of various strength. High tryptophan conversion/excretion has been achieved. Quantitative characterization of this conversion both in gram positive and in gram negative bacteria is under way. Preparations for continuous fermentation of tryptophan by the new strains have also been started.

Supporting grants from: OMFB to Orosz, Laszlo

Conformational Studies of DNA-Protein Complexes by Novel Gel Electrophoretic Separation Methods

Members: Orban, Laszlo Ph.D.; Varga, Laszlo Ph.D.; Buzas, Zsuzsanna Ph.D. (from Inst. for Biochemistry and Protein Research)

In collaboration: Prof. Chrambach, Andreas (guest);

This inter-institute collaboration has led to results which provide information about the conformational state (bending) of naked and protein-bound DNA fragments.

Supporting grants from: CEEI (FIC, NIH, MD, U.S.) to Orban, L. and from ICGEB to Orosz, L.

Transposition

Project leader: Olasz, Ferenc Ph.D.

The Transposition of IS30

In collaboration: Prof. Werner Arber, Biozentrum, Basel.

The research on the IS30 insertion sequence is based on a conservative model for the transposition of IS30 (Olasz et al 1993). In our model, an intermediate DNA structure plays the crucial role, which is formed by a site-specific deletion between two copies of IS30. We have presented experimental evidence that the resolution of this very active and unstable intermediate into final products can lead to transpositional rearrangements.

Isolation of IS Elements

Members: Szeverenyi, Ildiko M.Sc. and Bibo, Marton

We have constructed a "trap"-vector for easy and quick isolation of transposons and IS elements. We tested this construction in *E. coli* and isolated in various experiments 5 of the 9 IS elements resident in *E. coli*. Furthermore, we have isolated 2 new, unknown IS elements. This finding indicates that our vector can be used for the efficient isolation of IS elements. Our aim is to construct other vectors applicable to other bacteria, as well as to isolate new, unknown IS elements (manuscript in preparation).

Developing an In Vitro System Based on the IS30 Element

Member: Farkas, Tibor M.Sc.

The aim of these experiments is to study the conservative transposition on a molecular level, and to develop an in vitro vector system to insert foreign DNA into a wide range of pro- and eucaryotic organisms. We have developed a set of efficient tester plasmids and we are able to overproduce the IS30 transposase protein. Other aspects of our interest are the host factors needed for transposition, and the stability of IS elements.

The Target Specificity of the Mobile Element IS30

Members: Kiss, Janos M.Sc. and Bodoky, Tamas

IS30 has a pronounced target specificity, which is unique among the IS elements for two reasons. First, the transposition occurs very frequently into "natural" hot target sequences, which can be characterized with a consensus sequence. This sequence is 24 bp long with position

conserved less than 80 percent. Second, the inverted repeat ends of IS30 serve as a hot spot region for transposition. In these latter reactions intermediate structures were formed (see 2.1.). The most efficient structure for transposition is the intermediate structure itself. This process has similarities with the site-specific recombination (see 2. 6.) (manuscript in preparation).

Analysis of the Domain-Structure of IS30 Transposase Protein

Member: Farkas, Tibor M.Sc.

The N terminal 17 kD truncated part of the IS30 transposase protein is able to bind specifically to the inverted repeated region of the element (Stalder et al 1990). The mutants in the carboxy-terminal part of the transposase of IS30 are inactive in the intermediate-formation as well as in conservative transposition. The latter failure can be suppressed by an additional intermediate structure (the joined inverted repeat ends of IS30)—see 2. 1. This finding suggests that this part of the transposase is involved in intermediate-formation. A 24 amino acid long homology with the DNA-binding domain of Tn3 resolvases is present in this region. In addition, there is a DNA sequence homology between the IS30 IR ends and the consensus recognition sequence of the Tn3 resolvases, too (revised manuscript submitted).

Development of Site-Specific Recombination Systems Based on the Transposable Element IS30

Member: Kiss, Janos M.Sc.,

The reaction between IS30 intermediate structures (see 2.1. and 2.4.) share strong analogies and/or homologies to the site-specific recombination systems. The intermediate structure (the joined IS30 IR ends) and the transposase protein play the role of the DNA site and the recombinase protein, respectively. We have constructed systems from the IS30 in which the potential evolutionary origin of inversion- and resolution-systems can be studied.

Supporting grants from: OTKA 221/91, OTKA T6054/93 to Olasz, F.

RFLP in Animal Genetics

Project leader: Varga, Laszlo Ph.D.

Mapping and Identification of Genes with a Substantial Effect on Growth

Member: Szabo, Gyula M.Sc.

A new mouse mutant, called compact, is available for us and which appears similar to the muscular culard phenotype of domestic animals. Our aim is to determine the inheritance of the compact phenotype, to map the compact gene, to identify its sequence and finally to examine whether the homologues of this genes exist in domestic animals or not.

A crossing experiment has been carried out to determine the inheritance of this phenotype, and to map the gene. Data collected up to now from the F2 and backcross generations can be readily explained on the basis of a single gene model with variable expressivity.

We have established a marker map from equally distributed 76 microsatellite loci on the mouse chromosomes with an average 20-30 cM coverage. It will be possible to assign the compact gene to a certain chromosome with DNA samples collected from 250-300 F2 offsprings by using this map. The fine mapping will be accomplished with the help of additional chromosome specific microsatellites. The expected resolution of this fine mapping will be 0.5-1 cM.

Grant support: OTKA (National Scientific Foundation) 1992 - 1995 to Varga, L.

Generation of New Fingerprint Probes for Practical Animal Breeding

Members: Szabo, Gyula M.Sc.; Mikoldy, Dora

The aim of this project is to generate new fingerprint probes, in order to solve paternity cases for cattle, pigs, horses and sheep.

Genomic libraries have been made from these species. We screened these libraries with oligonucleotides of different lengths, which are suitable to pick up clones carrying minisatellite sequences. One thousand clones were chosen from different aspects identification of these clones is in process.

Grant support: OMFB (National Technical Developmental Committee) 1991-1993 to Varga, L.

Transgenic Fish

Project leader: Orban, Laszlo Ph.D.

Developing Alternative Gene Transfer Methods for Fish

Members: Prof. Horvath, Laszlo; Adam, Attila M.Sc.; Erdelyi, Ferenc M.Sc.; Lele, Zsolt M.Sc.; Muller, Ferenc M.Sc.; Papp, Tibor M.Sc.; Varadi, Laszlo M.Sc. (graduate students); Csapo, Zsolt (undergraduate student).

In collaboration: Williams, Darren Ph.D. (guest from UK)

Four different means of alternative gene transfer have been tested as possible replacements for microinjection into the animal pole of fertilized eggs prior to their first division. We have proven that fish sperm cells are able to bind exogenous DNA. However, the introduction of novel genes into the eggs of three fish species becomes possible only by electroporating the sperm cells. The efficiency of the transfer is very low (1-5 percent as detected by presence and expression of the transgene).

Liposome mediated gene transfer (developed at the BRC, Szeged for mammalian tissue culture cells) has been successfully adapted to dechorionated zygotes of fish, resulting in a promising gene transfer procedure for fish with surprisingly high ratio of larvae transiently expressing the transgenes.

Electroporation mediated DNA transfer into fertilized, dechorionated fish eggs has been improved by using a train of square pulses. Optimization of physical parameters such as field strength, pulse width and pulse numbers resulted in a reproducible transient expression in 25-50 percent of embryos and larvae.

We have found that exogenous DNA microinjected into the yolk of fish eggs is transferred into the blastomeres, and a-galactosidase activity expressed from the plasmid can be detected during the first few days of the development of embryos. DNA injected into the yolk results in significantly lower mortality and the occurrence of transiently expressing embryos is considerably higher than those of the traditional injection procedure.

Supporting grants from: OMFB to Orban, Laszlo OTKA to Muller, Ferenc.

Early Detection of Putative Transgenic Specimen

Members: Erdelyi, Ferenc M.Sc.; Muller, Ferenc M.Sc.; and Papp, Tibor M.Sc. (graduate students); Csapo, Zsolt and Mihalik, Balazs (undergraduate students)

Identification of the putative transgenic specimen by detecting the expression of a construct, containing an in vivo reporter or marker gene and cotransferred with the gene of interest, could reduce the amount of subsequent testing by laborious and expensive methods. Since no selective marker can be applied due to frequent mosaicism, we have chosen to study three genes for in vivo detection: firefly and bacterial luciferase as well as tyrosinase.

The gene of firefly luciferase can be applied effectively to detect transient expression during the early development of the embryos of all fish species used in our lab. The light produced as a result of the reaction catalyzed by the luciferase enzyme can be detected either by scintillation counter or by high sensitivity orthochromatic films. However, the substrate is very expensive. Replacement of the gene of firefly luciferase with fused lux genes of *Vibrio harveyi* has not resulted in measurable light emission by the two methods listed above.

The possibility of detecting transgenesis by reverting mutant body color to the wild type using the expression of transgenic tyrosinase gene is also under investigation. Isolation of the carp tyrosinase gene as well as the search for tyrosinase negative mutants are being pursued.

Supporting grants from: OMFB to Orban, Laszlo.

Isolation of Genomic Genes from a Carp Library

Members: Adam, Attila M.Sc.; Erdelyi, Ferenc M.Sc.; Setak, Attila (graduate student) and Wunderlich, Livius (undergraduate student)

Genomic libraries have been constructed from the DNA of common carp and zebrafish in our laboratory. The carp library has been tested by using a fragment of carp α -actin gene and found to be representative. The isolation of GH and tyrosinase genes is nearly completed one and four clones are under characterization, respectively. The use of these genes as well as their regulatory regions is planned in various species of fish.

Supporting grants from: OMFB to Orban, Laszlo.

Production of Transgenic Fish with Improved Characteristics for Aquaculture

Members: Adam, Attila M.Sc.; Erdelyi, Ferenc M.Sc.; Lele, Zsolt M.Sc.; Ferenc, Muller M.Sc.; Papp, Tibor M. Sc. (graduate students)

In collaboration with the group of C. Hew (Univ. Toronto, Canada) gene constructs containing the chinook salmon growth hormone gene driven by the ocean pout antifreeze promoter have been transferred this summer in Hungary into several thousand carp eggs. Fin clips and blood samples of more than 300 survivors are now being tested for the presence of DNA by Southern blotting and restriction-site polymerase chain reaction. The F1 generation of the transgenic specimen will be used to study the effect of GH genes on growth performance, feed efficiency and fat content of the body.

Supporting grants from: OMFB to Orban, Laszlo.

Developing Improved Methods for Gel Electrophoretic Separation of DNA Fragments

A short-term project supported by a CEEI research grant from NIH (Bethesda, MD, USA) for the period of 1991-1992 to Orban, L.

Member: Zsolnai, Attila undergraduate student,

In collaboration: Chrambach, Andreas Ph.D. (NIH)

Discontinuous buffers have been successfully applied to the separation of DNA fragments. These buffer systems provide numerous advantages over conventionally used continuous buffers (e.g. easy measurement of relative mobilities, digitalization of bands etc.). We have determined the separation effectiveness of several new discontinuous buffer systems for DNA, proved its compatibility with a conventional "submarine" type horizontal gel-electrophoresis apparatus and with a transverse gradient setup.

Gene Regulation in Plants

Project leader: Dallmann, Geza Ph.D.

Seed-Specific Promoters in Wheat

Members: Vibok, Ildiko M.Sc. and Nagy, Tibor M.Sc.

The wheat genomic library was screened using as probes the total coding region of gliadin gene (amplified by PCR) or a 30-bp oligonucleotide corresponding to the signal peptide region. Several authentic clones were isolated and one of these was further analysed in detail. In a detailed sequencing analysis, we revealed the promoter upstream conserved elements CCAAT and TATA boxes and, at - 300 position, the putative tissue specific element. Compared to the other gliadin sequences, about 85-90 percent homology has been found. In order to define the cis dominant regulatory elements and their function in a transgenic plant, series of vectors have been constructed. We combined the promoter upstream region of the wheat gliadin gene with 35S promoter as well as with rice actin conserved promoter, the reporter gene being GUS.

Supporting grant from: OTKA to Dallmann, Geza.

RFLP Studies with Wheat and Maize

Members: Hajos, Marta Ph.D. (guest), Orosz, L.D.Sc. (partial).

In this inter-institute cooperation (with Dept of Plant Genetics GATE and with Inst. of Plant Breeding of Hung. Acad. Sci.) a set of DNA probes from gliadin genes has been developed for the identification of wheat strains. In maize, RFLP analysis applied to investigate certain combinatory problems of isoenzyme subunits have arisen in tetraploid strains.

Supporting grants from: OTKA to Hajos, Marta Ph.D.

Plant-Parasite Interaction: Alfalfa and Cuscuta

Members: Lados, Miklos Ph.D.; Bakos, Agnes M.Sc.; Borsics, Tamas

Over 3,000 species of flowering plants utilize a parasitic mode of nutrition, yet basic knowledge about their physiology and biochemistry is limited and nothing is known of the genetic background of such relationships. Parasitic flowering plants are subdivided on the basis of their site of attachment to the host (root, stem). The distinguishing feature of all parasitic plants is the haustorium, a novel organ that functions in attachment, penetration, and solute transfer. Parasitic plants vary greatly with respect to host range (narrow and broad host range species). Our model system for studying the plant-parasite relationship is the *Cuscuta trifolii*/alfalfa interaction, since this host plant is one of the most important legumes in Hungarian agriculture. During the last year we have worked out the proper laboratory conditions for the reproduction of natural parasitism. Using this system we collected physiological data on environmental factors (temperature, pH, host, plant, etc.) affecting the germination of *Cuscuta tr.*, we started the isolation of mRNA from the haustoria and preparation of cDNA library containing parasitism specific gene products.

Further aims of the project:

Identification of genes specifically expressed in haustorium and/or the stem cells of the host plant by using differential cDNA hybridization. Connected to this, we have to work out the special conditions for DNA and RNA isolation from different organs of the parasite. The characterization of the isolated "parasitism-specific" DNA fragment by sequencing and functional analysis, as well as clearing up the number and/or size of chromosomes are also parts of our program.

We hope that clearing up the mechanisms of host and flowering parasite relationships can give a theoretical basis for developing new, more effective and "environmentally friendly" technologies for the protection of cereal and legume crops (from the attack of parasites).

Supporting grants from: OTKA to Lados, M., OMFB to Lados, M.

Participation in Research Projects of Other ABC Institutes

- Utilizing site specific recombination in manipulating vaccinia virus; project leader: Papp, Istvan IMG; in collaboration: Fodor, Istvan D.Sc. IBPR
- DNA/Protein sequence specific recognition; project leader: Orosz, Laszlo. D.Sc. IMG; member: Pongor, Sandor D.Sc. IBPR
- Extranuclear DNA elements in filamentous fungi; project leader: Papp, Istvan IMG; in collaboration: Hornok, Laszlo Ph.D. IPS

Hungary: Biochemistry, Protein R&D Center Presented

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[Unattributed report: "Agricultural Biotechnology Center: Institute for Biochemistry and Protein Research"]

[FBIS Transcribed Text]

Staff

Director: Prof. Pongor, Sandor, D.Sc. biology (footnote) (Presently Head of the Protein Structure and Function Program and of Computer Services at UNIDO's International Centre for Genetic Engineering and Biotechnology, Trieste, Italy)

Acting director: Prof. Graf, Laszlo, Ph.D., D.Sc. biology

Deputy director: Asboth, Bence Ph.D. biology

Secretary: Kiss, Magdolna

Senior scientists: Buzas, Zsuzsanna Ph.D. biology; Fodor, Istvan Ph.D., D.Sc. biology; Kaliman, Alexander Ph.D. biology; Patthy, Andras Ph.D. pharmacology;

Ph.D. students: Boldogkoi, Zsolt M.Sc. biology; Rencendorzs, Altanchimeg M.Sc. biology; Sasvari, Zsuzsanna, M.Sc. agr.eng.; Szabo, Erika M.Sc. agr.eng.; Szeibert, Aniko M.Sc. biology/chemistry; Varallyay, Eva M.Sc. biology/chemistry; Hatsagi, Zsolt, M.Sc. biology;

Research associates: Antal, Jozsef M.Sc. chem.eng.; Antal, Krisztina M.Sc. chem.eng.; Braun, Attila M.Sc. biology; Fabian, Peter M.Sc. chemist; Polner, Gabor, M.Sc. (footnote) (left the Institute); Fodor, Nadia M.Sc. biology; Hegyi, Hedvig Ph.D. physicist; Murvai, Janos M.Sc. agr.eng.;

Technical staff: Bergan, Judit; Erdelyi, Edit; Halasz, Marianna; Hamza, Magdolna; Illes, Aniko; Szigeti, Aniko

Goals

The Institute for Biochemistry and Protein Research (phone: (36)-28-320-095; Fax: (36)-28-330-338) of the Godollo-based Agricultural Biotechnology Center [ABC] was established in order to develop novel protein products for agricultural use. The history of numerous Western biotechnology companies shows that this is an enormous task and the success of such activity can only be expected from carrying out basic research of a high international standard. Design and construction of novel protein products requires a combined use of computer aided design, gene technology, protein chemistry and (at least) in vitro pharmacology of the products. It follows

from this wide spectrum of methodology alone that the Institute's activity should concentrate on a limited number of projects of scientific and agricultural interest. Thus, at the present stage, decreasing rather than increasing the specific research goals of the institute appears to be a reasonable object. Accordingly, among projects in cooperation with the Department of Chemistry/Biochemistry of the University of Agriculture, Godollo, investigations on *B.thuringiensis* toxin have been completed by synthesis and structural analysis of a peptide segment with assumed haemolytic properties, and lectins from *Vicia faba* and *Lathyrus sativus*, produced in a quality and quantity appropriate for biotechnological usage, are conveyed for commercialization to Reanal Chemical Co., Hungary.

Research

The institute consists of the following units: Biochemical Analysis and Synthesis, Bioinformatics and Protein Design, Enzymology and Protein Technology, and Molecular Virology. As far as programs are concerned, the vaccine development program focuses on the molecular biology of animal pathogens like fowlpox and the Aujeszky viruses, and has partly been carried out in collaboration with Phylaxia-Sanofi. The main goal is to understand the molecular mechanism of the action of animal viruses in the hope of developing better tools for prevention and treatment.

Targets of the enzyme program are enzymes of starch bioconversion (glucose/xylose isomerase, glucoamylase) and serine proteases. The mechanism of the action of proteases has been a traditional interest of the institute and several other groups of the country. Joining the efforts of these groups is in progress now. For example, four scientists of this Institute and five at the Department of Biochemistry, Eotvos University, Budapest, are now involved in a coordinated serine protease project. This joint research program is part of the recently reformed PhD system in Hungary, and is hoped to strengthen the unity of research and teaching activities within the country.

The above programs have already been backed by the service of the other two groups and integration of these activities should and will be strengthened. The analysis and Synthesis Laboratory is a comprehensive core facility that provides N-terminal sequencing, peptide- and DNA syntheses and amino acid analysis for a number of other laboratories inside and outside ABC. The protein technology arsenal of the Institute has been extended further by the recent establishment of the protein crystallisation laboratory, a result of joint efforts of the Enzymology and Protein Technology Group and the Eotvos Lorand, University of Sciences Budapest. This is an outstanding example of how fruitful the ever expanding collaboration with universities might prove.

Another example is ABC's computer system, whose molecular biology services are developed under the scientific supervision of the band pd [as received] group.

Bioinformatics and Protein Design

Project leader: Pongor, Sandor D.Sc.

Members: Asboth, Bence Ph.D.; Fabian, Peter M.Sc.; Hatsagi, Zsolt M.Sc.; Hegyi, Hedvig Ph.D.; Murvai, Janos M.Sc.; Patthy, Andras Ph.D.; Polner, Gabor M.Sc.; Szabo, Erika M.Sc.

In collaboration: Dr. Allende, Jorge, University of Santiago, Chile; Dr. Blanco, Alejandro Labra, Irapuato, Cinvestav., Mexico; Drs. Falaschi, Arturo, Baralle, Francisco ICGEB, Trieste, Italy; Dr. Veljkovic, Beljko; Dr. Metlas, Radmila, VINCA Institute, Belgrade, Yugoslavia; Prof. Sajgo, Mihaly University of Agriculture, Godollo, Hungary

The design and construction of novel protein products relies on a combined use of molecular biology (protein engineering), computer aided design and protein chemistry. The primary goal of this project is to design methods capable of extracting useful structural principles from protein databases, and applying these methods for the solution of practical problems such as the design and construction of biologically active peptides.

One of the basic tasks of molecular biology is the identification of functional domains in protein sequences. We have constructed and maintain SBASE, a database of protein functional domains that currently contains over 34,000 annotated domain sequences consistently named by function, structure and/or cellular location. In addition, we have developed methods that have made it possible to extract domain homologies as well as characteristic sequence patterns using fast database search methods. Current plans include the development of a standard classification scheme for protein domains based on cluster analysis. The database and the software tools which have been developed are available through anonymous electronic file transfer (FTP [file transfer protocol]).

Pattern search methods were used to identify a domain of the human retrovirus HIV-1 glycoprotein gp 120 which bears structural similarities to human immunoglobulins both at the protein and at the DNA level. This finding allowed us to predict an involvement of the VH-III immunoglobulin family in AIDS pathogenesis, which has recently been experimentally proven.

A novel amylase inhibitor, identified in the Mexican crop plant, *Amaranthus hydrochondriacus*, was purified and sequenced in collaboration with Cinvestav, Irapuato, Mexico (Alejandro Blanco Labra, Alicia Chagolla) and ICGEB Trieste. Identification of the disulphide pattern in this protein allowed the prediction of potential insecticidal activity, now experimentally verified. Modelling studies show that the protein bears homology with known cysteine rich domains. In a joint research project with the University of Agriculture, Godollo, a similar approach was used for the study of another insecticidal protein, the *Bacillus thuringiensis* toxin. Modelling studies and in vitro tests showed that an amphiphilic segment of this protein may be responsible for the haemolytic activity of some *B. thuringiensis* toxins.

Phosphorylation of proteins at hydroxyl groups plays a key role in most regulatory processes of eukaryotic cells. The enzymatic specificity of casein kinase I and cdc2 kinases was studied with synthetic using synthetic peptide substrates designed based on modelling studies. The phosphorylating activity of cdc2 kinase was tested with a battery of 25 synthetic peptides and the results indicate that a turn conformation and an array of positive charges are essential for efficient phosphorylation.

Proteolytic activation seems to play a key role in the life cycle of the insect parasite *Trypanosoma cruzi*, a chicken

parasite and a causative agent of Chagas disease in man. It was found that the protein responsible for the activation of the parasite is an N- fragment of the chicken minor hemoglobin that is produced by an insect enzyme upon transmission of the parasite via insect bites. Structural modelling of the fragment shows that steric accessibility rather than sequence variations are responsible for the specificity of the interaction which in turn may be a crucial factor in determining the host specificity of the parasite.

Current work is directed towards the application of the modelling approach to various other biologically active peptides, to DNA/protein interactions as well as to specific sequence motifs of DNA

Enzyme Program

Of the targets of the enzyme program, glucoamylase and glucose isomerase are utilised in the production of high fructose content syrup, whereas trypsin and acrosin play a decisive role in digestion and fertilisation, respectively. The computer-aided analysis of the mechanism with molecular graphics on a SYBYL system and the protein crystallization laboratory, in collaboration with Prof. Naray-Szabo, Gabor and Dr. Bocskey, Zsolt, substantially contribute to these projects.

Starch Bioconversion Enzymes

Project leader: Asboth, Bence Ph.D;

Members: Fabian, Peter M.Sc.; Sasvari, Zsuzsanna M.Sc.; Szabo, Erika M.Sc.; Szeibert, Aniko M.Sc., Varallyay, Eva M.Sc., graduate students.

In collaboration: Prof. Hartley, Brian S., Imperial College, London; Prof. Naray-Szabo, Gabor, University Eotvos Lorand, Budapest; Dr. Hoschke, Agoston University of Horticulture and Food Industry, Budapest.

The general primary aims have been to increase the heat stability of both agro-industrial enzymes as desired by their industrial usage and to decrease the inhibition of glucose/xylose isomerase (GXI) by Ca^{2+} . Muteins of the latter have been produced and shown to display altered metal binding properties. Further guidelines for site-directed mutagenesis are expected from molecular modelling and theoretical chemical studies carried out in cooperation with Professor Naray-Szabo, G.

Investigations on glucoamylase have been focused on the topology of inactivation. The results of limited proteolysis and heat denaturation studies in the absence and presence of substrates suggest sites where protein modification should increase heat stability without significant loss of enzymic activity.

Successful crystallisation of GXI mutants have already provided protein crystals suitable for X-ray studies. 3-D structure is to be determined at the Protein Structure Centre to be started late this year.

Supporting grant from OTKA.

Specificity and Activation of Serine Proteases

Project leader: Graf, Laszlo, academician.

Members: Antal, Krisztina M.Sc.; Asboth, Bence Ph.D.; Fabian, Peter M.Sc.; Patthy, Andras Ph.D.; Szabo, Erika M.Sc.; Varallyay, Eva M.Sc.

In collaboration: Polgar, Laszlo D.Sc., Inst.Enzymol. BRC, Acad.Sci.Hung.; Rutter, W.J. University of California

The enormous advances in site-directed mutagenesis of proteins have led to a renewed and rising interest in the molecular mechanisms of enzyme catalysis. A deeper understanding of the structural basis of substrate specific catalysis and of the stability of enzymes bear on our ability to modify these structures artificially for practical purposes.

The mechanism of substrate specific catalysis of serine proteases has been the focus of interest for scientists at both the Institute for Biochemistry and Protein Research, and the Department of Biochemistry, Eotvos University. By the joint efforts of these two groups, the substrate specificity of a newly designed trypsin mutant has recently been determined: This mutant enzyme exhibits selectivity toward tyrosyl bonds of peptide substrates, a specificity unknown among natural proteases. Further studies are being carried out to explore the precise molecular mechanism of activation of trypsinogen, chymotrypsinogen and proacrosin, and to reveal the general role of these related mechanisms in the regulation of proteolytic activity *in vivo*. For these studies enzyme, chimeras have been prepared by genetic engineering, in which certain elements of the zymogen activation domains are interchanged. Preliminary studies along these lines support the recent proposal by this group that different conformational flexibilities of the activation domains also represent the structural basis for different substrate specificities of the mature proteases. Hopefully, these studies on the structural basis of the activation mechanism and substrate specificity will open up new possibilities for designing and creating mutant enzymes with optional specificity and enhanced stability for practical use.

Recombinant Vaccines

Project leader: Fodor, Istvan D. Sc.

Members: Boldogkoi, Zsolt M.Sc.; Braun, Attila M.Sc.; Fodor, Nadia M.Sc.; Kaliman, Alexander Ph.D.; Altanchimeg, Rencendorsh Ph.D.

In collaboration: Prof. Dube, Shyam University of Maryland; Dr. Grabko, V. Institute of Biochemistry and Physiology of Microorganisms (IBPM) of the Russian Academy of Sciences

Our virology research is aimed at developing new expression systems for viral antigens based on animal viruses as expression vectors. This strategy may allow us to obtain recombinant subunit or live vaccines for animals against important viral infectious diseases. A number of viruses can now be considered as potential vectors. In our studies, we focus on recombinant poxviruses, herpes viruses and baculoviruses.

a. Poxviruses

The vaccinia virus-vector currently appears to be attracting a great deal of interest for use as a vaccine for humans and animals. Strategies have been developed for the insertion and expression of foreign genes in vaccinia virus without loss of infectivity. The vaccinia virus in this case serves as a vector for inoculation of the organisms with the functionally active foreign genes of antigens.

In cooperation with the Institute of Biochemistry and Physiology of Microorganisms (IBPM) of the Russian Academy of Sciences, we are working on the construction of polyvalent vaccinia virus strains expressing multiple heterologous genes. Recombinant insertion plasmids were constructed carrying *E. coli*-galactosidase (*lacZ*) and firefly luciferase (*luc*) genes under the control of vaccinia (VV) promoters flanked with a VV DNA *HindIII* N fragment, sequences encoding thymidine kinase (*tk*) and hemagglutinin (HA). For insertion into the N site, a new transfer vector was constructed. A comparative analysis of *lacZ* and *luc* activities in the transient expression system showed that the efficiency of the enzyme expression for all constructs was entirely determined by the VV promoter. To characterize the expression of heterologous genes in different regions of the VV genome recombinants were constructed by using insertion vectors based on the N fragment, *tk*- and HA sequences, and the reporter gene *lacZ* or *luc*, or both. Studies on recombinant viruses show that the expression of reporter genes does not depend on the location of the genome and is determined by the promoter. Finally, we constructed a recombinant VV, strain Lister, expressing a reporter gene along with genes encoding hepatitis B core and surface antigens.

Studies are under way on the biochemical characterization of recombinant vaccinia expressing antigens of Newcastle disease virus and rabies virus.

Fowlpox virus is a possible alternative to vaccinia vaccines as it has a limited host range and does not infect humans. As part of our interest in using a fowlpox virus as a vaccine vector, in cooperation with the Phylaxia-Sanofi Veterinary Biological Co. in Budapest, we have developed a novel fowlpox virus vector system suitable for the incorporation of heterologous genes.

b. Herpesvirus

We have cloned and determined the entire DNA sequence of two adjacent open reading frames of the ribonucleotide reductase genes of the Aujeszky's disease virus. From the sequence analysis we predict that genes encode a ribonucleotide reductase which comprises two polypeptides—large and small subunits (RR1 and RR2), with the sizes of 835 and 303 amino acids, respectively.

RR1-mutants are avirulent and induce protection against clinical signs after infection with virulent ADV. Thus, RR1-ADV strains could be considered as potential vaccine candidates. In addition, these mutants could be useful vectors for gene delivery into neuronal cells, and peptide inhibitors of the RR enzyme may serve as a lead compound for anti-ADV drugs.

c. Baculoviruses

Baculovirus expression systems have been used for synthesis of subunit vaccines. Using recombinant baculovirus strains of AcNPV and BmNPV expressing firefly luciferase, we have demonstrated that the hemolymph of certain insect larvae accumulates a high concentration of the heterologous protein product and in some cases the production of the protein in larvae is preferable.

Supporting grants from OMFB, OTKA, ICGEB and Phylaxia-Sanofi to Fodor, Istvan.

Daimler-Benz, Other German Firms Develop Expert Systems Software

95WS0210A Munich TOP-BUSINESS in German
Feb 95 pp 82-86

[Article by Thomas Finn: "Master of Diagnosis"]

[FBIS Translated Text] **Skilled is skilled and that also holds good for computers by now. For smart software is making headway. Anyone currently using it is deriving significant competitive advantages.**

The gentleman is tight-lipped. Thomas Forchert, "Knowledge-Based Diagnostic Systems" (WDS) project supervisor at Daimler-Benz AG [Incorporated], refuses to give precise data on the strategy for introducing his baby. For good reason: the abbreviation whose expansion is "knowledge-based diagnostic system," harbors a new software wonder weapon from which the firm has high hopes for a number of competitive advantages. Forchert can be drawn out only a bit about it: "In upcoming years we are planning to install WDS across the full expanse of our vehicles line."

Anyone familiar with the development of the diagnostic system and its underlying new software technology understands his discretion. WDS is not going to leave one stone on another in all segments—product development, production, suppliers, dealers or repair shop network. The comprehensive computer program is "currently one of the largest industrial projects in the area of knowledge-based systems," explains Norbert Waleschkowski, not without pride. The reason, after all, is that the director of corporate-sector artificial intelligence [AI] for Danet GmbH [Limited] in Darmstadt is the father of WDS. It was his company that assembled the program code.

The introduction of the expert system, operating with artificial intelligence methodology, marks a decisive software breakthrough: the programs ultimately are capable of learning on their own; they are, as it were, inherently smart (see box, page 86). The managing director of the German Research Center for Artificial Intelligence (DFKI) in Kaiserslautern, Detlev Ruland, opines: "Using artificial intelligence we are presently solving practical problems."

Extreme Demands

WDS is simply capable of anything. The computer keeps tabs and close eye on the entire vehicle, it makes no difference whether hydraulics, mechanics or engine, but, above all, the numerous electronic systems. If, in the future, a driver of a Mercedes comes into the repair shop with a muddled description of defect, the mechanic will input the description in the queries window of the display unit. That is when the Danet software goes into action. Plugged into the vehicle's electronics, WDS independently thoroughly checks out the car in interaction with the technicians.

Even though there is no sitting in the car, as if controlled by the hand of a ghost, the engine accelerates or adjusts the throttle valve. The wiring is fully tested and the steering system is examined. If the computer needs manual support, a voltage measurement, for instance, the program communicates its desire to the mechanic. In this manner

the WDS keeps narrowing down the possible defects until there is eventually an unequivocal diagnosis.

The demands could not be more extreme: Given an annual production of 100,000 vehicles, only two or three cars are actually identical. Otherwise, lower drives, different engines or optional equipment makes each car individual. "And that has to drive the diagnostic system," as Daimler-Benz pioneer Forchert requires of his software suppliers.

The solution: the program asks the electronically connected equipment for their identity. Based on the replies, the WDS, together with the data stored in the knowledge base, creates the individual working model of the respective car and, in fact, as AI visionary Waleschkowski underscores, "down to the smallest interchangeable unit."

On this basis the software makes a preliminary determination of the diagnostic strategy that bodes to be most promising. It consists of three different methodologies: case-based test processes, those based on the cause-effect theory or those derived from the working model.

Sophisticated Know-How

In this context there is no predefined approach. Waleschkowski explains: "WDS completely takes its lead from the situation and after each step makes a fresh decision on how it will further proceed." What is more, the software is capable of learning: cases that have been solved are stored and in this way enlarge the experiential storehouse, the system's know-how base, should there later be similar occurrences again of the stored defects.

The demand for such diagnostic tools simply cannot be overestimated. Waleschkowski underscores the need: "Technical systems like cars, aircraft, machine tools or switching systems have reached a level of sophistication that there is simply no way to keep tabs on them without similarly sophisticated resources." A single statistic justifies the software pioneer: in the automotive industry it is estimated that only about 30 of the 100 electronic parts removed in repair shops and sent back to the manufacturers for repair are really defective. The Kff rate—"Kff" stands for no detectable defects—is 70 percent on average. Daimler-Benz's Forchert is positive that WDS will dramatically reduce such rates.

And not just that. WDS will also change the production of vehicles. Already in product development, working models and diagnostic strategies are to be formulated in the future—even by suppliers. The vehicles can be thoroughly checked out in a more streamlined manner prior to delivery. Since WDS enable centralized assessment of repair data from the repair shops the company will much more quickly have a clear idea of where failures and defects are occurring the most facilitating rapid reaction and feedback in development and production.

Over the long haul Germany's largest firm intends adapting WDS not only to cars but also to other products like aircraft, for example, or vehicles operating on rails. To do so, however, the knowledge base will have to be modified, but, based on the experience of Danet's AI chief, Waleschkowski, that will not be a humongous undertaking. Adaptation to other technical systems is likely to take a year at the most, in the estimation of the software expert.

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Therefore, in agreement with Daimler-Benz, Danet is eager later to market the program as a product—even for other branches.

Advantages for Customers

Even though Daimler's WDS is a trailblazing system, still, it is certainly not the only one. The entire market for expert systems is effervescent. Standardized solutions are to hand for more and more applications regardless of whether they entail automated checking of credit and insurance applications, investment strategies for securities, speech, handwriting or image recognition, smart operating instructions.

Back of the boom is increased and cheaper computing power and software tools such as "AionDS" from Trinzic Deutschland GmbH, Cologne. Tailored for integration-ability and practical application, AI systems have finally catapulted out of the ivory tower.

Wherever expert systems have already passed their field tests they are yielding impressive competitive advantages to the firms using them. For example, the Royal Bank of Canada is monitoring its credit card business with the help of knowledge-based software and is saving nearly \$1.5 million a year because of quicker detection and more effective analysis of cases involving fraud.

York International, a producer of air conditioners, ventilation and heating equipment, is using the smart technology for speedier and more accurate formulation of estimates. If previously engineers needed as much as three weeks for that, drawing up an estimate now takes only a few days.

Precise Planning

Even at the Hamburg branch of Deutsche Aerospace Airbus GmbH (DASA), the smart software has proven its worth. From limited data it automatically generates complete working plans that can be prioritized as required by optimizing throughput time or cost reduction. As a result it was possible to halve the outlay for work planning and the quality of the plans could be decisively improved. DASA is now pondering assembly plans and diagnosis using expert systems. As Konrad Bauer-van Geoens, Trinzic's managing director, sums it up: "There is virtually no area of the economy—in production or administration—that could not currently benefit from smart software."

But that is just the beginning. In the development laboratories of industry, universities and research institutes, software experts are already working on even more powerful programs that will, for example, quickly, dependably and correctly interpret the meaning of a text or images and video sequences. Self-steering vehicles, robots with vision, automated translation of texts into a foreign language, natural dialogue with a computer: in the opinion of Darmstadt's AI expert Waleschkowski, "Success in these areas is just a matter of time."

[Boxed item, p 84]

ABC of Applications: Where Expert Systems Are Currently Being Applied

Wherever large, diversified fields of knowledge need to be assessed simultaneously in order to use them eventually to

perform standardized routine tasking, the computer is capable of taking on this assignment. The fields where expert systems are even now yielding customers competitive advantages include:

—Systems control: expert systems run systems at the optimum operating point. In split seconds they detect deviations from the target value, analyze the causes and take compensatory action.

Practical example: At the Preussen Elektra power plant in Staudingen, ABB Power Plant Control Technology optimizes the steam cycle.

—Diagnosis/maintenance: The expert system is larded with rules indicating symptoms of possible failures and breakdowns—for instance, temperature changes, fluctuations. Simultaneously, the computer, connected, for example, to the motor vehicle's electronics, can perform tests on its own to locate sources of failures.

Practical example: Daimler-Benz is planning a diagnostic system for passenger car repair shops that is later to be transferred to other technical systems, aircraft, for example.

—Working plans: the experiences of work planners as to which components made of which materials with which machines and in which sequence can be best produced, are stored as a knowledge base in the computer enabling it to automatically formulate working plans.

Practical example: At the Hamburg-Finkenwerder plant, Deutsche Aerospace has working plans automatically generated and is eager soon to use expert systems to draw up assembly plans too.

—Credit checking: On the basis of definite rules the computer in a matter of seconds determines whether an applicant should or should not be granted credit.

Practical example: Citibank is already operating with such software.

—Design: the software—backed up by design rules and criteria such as dimension, stresses, performances—makes recommendations or even fully automatically prepares entire components.

Practical example: The first systems are installed at Mercedes-Benz in Stuttgart.

—Securities business: what does the customer want, what is his preferred investment strategy (more conservative, more venturesome), what financial latitude does he have? The expert system derives from such inputs an individualized securities investment.

Practical example: Simply using the Ramses expert system, Citibank was able in a short period to extensively develop this line of business.

—Risk analysis: occupation, age, hobby, illnesses, stays abroad, nationality: anything spelling an insurance risk and therefore the terms for the customer when signing up, for example, for health or life insurance, is contained in the database as a knowledge base. In 95 percent of all instances the computer thereby replaces qualified risk analysts.

Practical example: Rueck of Cologne has developed such a system as a basic model that, meanwhile, is being used at a number of first-time insurers.

France: Researchers Explore Chemical Computer Technology

BR0103150495 Paris SCIENCES ET Avenir in French
Mar 95 pp 88-89

[Report by Eric Glover: "The Chemical Computer: Smaller, Faster"]

[FBIS Translated Text] "The smaller the better" is the motto of electronics and information science specialists. Small and efficient. At the extreme, the smallest model is the one which reaches a molecular or even atomic scale. A caricature for many people who think an electronic component is an electronic component and a molecule a molecule. To this we can add that a cat is a cat and a goldfish a goldfish and therefore measure the technological ambitions of these people. Fortunately there are others. Those whose work is increasingly leading us to the mini-computer of the future, or the chemical computer.

It must be said that the course followed by the different teams involved in chemical electronics has not always been the same. But as Pierre Dac once said nothing is more identical than something which is similar to the same thing. In this case the expertise gained from two different types of logic converging toward a single goal, notably to avail, in the long term, of microscopic chemical components measuring a couple of nanometers equipped with the basic properties of macroscopic electronic components.

The first type of logic begins by making components entirely in molecular matter and then endeavoring to make them smaller. This course was followed successfully by Francis Garnier at the CNRS [National Center for Scientific Research] molecular laboratory. He has just made an all-plastic transistor. This is the first time this has been achieved and is attracting the interest of Philips and Matsushita.

The second type of logic is to create molecules which will behave in the same way as classic electronic components. These molecules will be subsequently connected together in the classic electronic way.

The main difficulty in this method is the scale factor. Because these atomic groups are difficult to handle. Manipulating these molecules requires the nimble technique used by Jean-Pierre Launay of the CNRS materials elaboration and structural studies center. He has managed to construct molecules which allow electrons to be transferred with minimal losses and which can be used as connection wires. He has also obtained atomic groupings which behave like a switch. When "on" the current passes, when "off" it does not pass.

Another magician is Olivier Kahn, of the inorganic chemical laboratory of the Paris-Sud University, who has developed atomic constructions capable of reflecting a local occurrence at a distance, due to magnetism. Some of these constructions even have the extraordinary capacity of remembering an occurrence such as the direction of the passage of current. The phenomenon is called hysteresis.

Thanks to the skills of researchers we now avail of true chemical electronics: organic transistors, molecular wires and switches, matter with memory. However, amplification, a major piece of the puzzle, is still missing. Jean Launay has already started tracking it. If he is lucky this will doubtless be the final step before the construction of a chemical computer.

Triangular Logic

Classic computers provide results that Francis Devos (Fundamental Electronics Institute, Orsay) compares to a dot. He is interested in occurrences which appear when several "dots" are joined together. The image he uses to describe his method is that of the triangle. One dot provides one element of information but three dots provide four, one per dot plus the triangle made by these dots. It is these uncalculated but existing structures which are at the basis of a new concept of computer architecture which allows both local capacities of the dots to be used and more generally the triangles. This concept is compatible with the component molecules whose size limits the capacity to transmit information at a distance.

Plastic Transistor

Francis Garnier has been working with a view to reproducing the semiconductor properties of silicon using organic components. The main problem is to obtain a comparable charging mobility of 1,000 units. This mobility measures the electron's facility of movement within the semiconductor. It conditions the effectiveness of the transistor. These 1,000 units have for a long time been like Mount Everest to chemists. Even today they are still only climbing the lower slopes but their performances are improving. From a mere 10 to the power of minus 6 unit (a billion times too little), the researchers have climbed the Mont Blanc and they are now obtaining 10 to the power of minus 1 unit mobility and they hope to reach five times this mobility, or 5 times 10 to the power of minus 1, in the long term. Francis Garnier is now working on reducing his transistor in size but he thinks that from a certain size onwards, quantum effects will arise and prevent radical miniaturization.

Memory of Matter

Hysteresis is a property linked to temperature in certain matter or molecules. One example is when electric current, or electrons, are sent toward a group of molecules. This current crosses the group when the temperature is increased. At 305 K, it passes completely. When the temperature is reduced, the current continues to pass up until 290 K and only falls after this point. An observer noting that the current passes completely at 295 K is therefore capable of saying if the electrons are outbound or incoming in direction (incoming in this case). The matter memorizes the direction. This is hysteresis. This property has its origin in the behavior of molecules among themselves. If a sufficient number of links are created between the molecules, in other words if they behave as polymers, hysteresis takes place.

Israeli Supercomputer Outperforms U.S. Computers

*BR2302125795 Paris AFP SCIENCES in French
16 Feb 95 p 6*

[Unattributed report: "Supercomputer Developed in Israel"]

[FBIS Translated Text] A supercomputer has been developed by the Hebrew University of Jerusalem. The latter says that it meets all the scientific needs of the State of Israel.

"This computer which can perform 4 million operations in a second," a spokesman of the university said on 14 February, "can be further improved and outmatch the computers manufactured in the United States." He added that Israel is now one of the few countries which have the necessary equipment for leading-edge research, namely for physics, biology, chemistry, and mathematics.

The administration of former President Bush opposed the sale of two U.S. supercomputers to Israel, fearing that they might be used for a nuclear simulation program or for a neutron bomb development program.

France: Naval Air Fleet Chief on Rafale Program*95WS0197A Paris AIR & COSMOS/AVIATION
INTERNATIONAL in French 2 Dec 94 p 25*

[Interview with Vice Admiral Jean Wild, Naval Air Fleet chief, by Jean de Galard; place and date not given: "Rafale: Five Years To Refine Air-to-Air Version; 10 Years for Multipurpose Version"]

[FBIS Translated Text]

[Galard] Are you satisfied with the progress of the Naval Rafale program?

[Wild] So far I am very satisfied with the progress of that program. That judgment applies for the moment to development of the system and, in particular, the electric flight controls and the engine. This does not mean that there have been no difficulties, and it is normal to encounter some in all new programs. In particular, the tests in the United States highlighted considerable levels of vibration during catapulting and of shock when engaging the arresting gear. Those tests made it possible to work out solutions for ensuring good performance by the onboard equipment. The concepts as engineered were thus validated.

It remains now to continue development of the weapon system, and that means a lot of work. We have five years ahead of us in which to refine the interception (air-to-air) version of the Rafale and 10 years in which to reach the final stage of the weapon system for the multipurpose version, including all ground and sea attack functions. All the information available enables me to say today that we will succeed. So I am very confident.

[Galard] Does the performance of the fully loaded aircraft meet the Navy's specifications?

[Wild] The three series of trials conducted on the aircraft carrier Foch in April 1993 and then in April and October 1994 confirmed the validity of the choices made: during the last series of trials, all the chosen objectives were achieved. The Rafale MO2 executed 25 catapultings, including two at night, and some of them involved a weight of 18 metric tons. It executed 25 daytime deck landings, some with a weight of 13 metric tons. Weights that great had never been achieved on that type of aircraft carrier, and everything went off perfectly well. The aircraft's fast turnaround immediately after catapulting poses no problems for the pilot, although it had been feared that he might be bothered by the lack of external reference points. In the case of the RBE2 radar and the Spectra countermeasures system, we were also able to inspect the engine to determine status and maintenance needs (VAMOM), and the results were satisfactory. In short, the Foch and the Rafale were judged to be an excellent match. The first mass-produced Naval Rafales in their interceptor version should be received in 1998 so that the first squadron to be set up can be operational in the summer 1999.

[Galard] When will the Hawkeyes arrive?

[Wild] The planning law provides for a total of four, two before the year 2000 and two after that. This involves the E-2C group, which is also used by the U.S. Navy. The

current timetable calls for the first two of those aircraft to enter service on the Charles de Gaulle as soon as that aircraft carrier enters active service on 1 July 1999. I would like to emphasize in this connection that the often-used term "shipborne early warning aircraft" is very restrictive. Actually, the Hawkeye is capable of 360 degrees of surveillance within a range of 360 km (200 nautical miles) while simultaneously providing guidance for offensive raids on land as well as at sea (Editor's note: on this subject, see the diagram on page 30 [not included here]).

[Galard] How are the Super Frelons and Lynxes aging?

[Wild] The fleet of Super Frelons consists of 17 helicopters, including 12 doing front-line duty. Thanks to the steps taken to reduce flying hours and the policy for managing our inventory of rotor blades, they should be able to remain operational until 2005. It can be said that they are aging well. Our real problem as far as the WG-13 Lynxes are concerned is that there are not enough (we have 34 left out of the 40 that were ordered) for all the helicopter carriers we have. The 26 Lynxes on the front line are divided between Squadron 31F, which is based in Saint-Mandrier and supplies the units of the Naval Action Force, and Squadron 34F, which is based in Lanveoc-Poulmic and supplies the submarine action group. Management of the operational Lynxes is a matter of three priorities: the presence of a helicopter of that type on every helicopter carrier, the presence in each squadron of three Lynxes for training, and the distribution of the remaining Lynxes among the various ships based on their missions.

[Galard] What can you say about the NH-90?

[Wild] What I have just said about the Super Frelons and Lynxes makes it clear that the arrival of that future European helicopter in the Navy after the year 2000 is a vital necessity. Weighing nine metric tons, that helicopter in its combat version will have antisubmarine and antiship capability, and in its transport version it will replace the Super Frelon in the latter's logistic missions to the naval forces. Managing the program is difficult because the aircraft is of interest to four countries, three of which also want to acquire it for their ground forces; a collective approach is underway to reduce costs. For my part, I remain very optimistic.

[Galard] Are you concerned about the future of the Naval Air Fleet?

[Wild] I don't have any real concern except to see to it that the program for replacing the Naval Air Fleet's aircraft proceeds in a consistent manner. It was necessary to spread the program out over time because no budget can absorb the simultaneous replacement of 100 percent of the fleet every 30 years. The maritime patrol aircraft are already being replaced with Atlantique-2's. Having the PAN [nuclear-powered aircraft carrier] and the Rafales without Hawkeyes makes no sense, and having frigates without helicopters means seriously burdening their operational capability. It is necessary to always combat inconsistency.

France: Naval Air Fleet Modernization Program

95WS0196A Paris AIR & COSMOS/AVIATION
INTERNATIONAL in French 2 Dec 94 pp 22-24

[Article by Jean de Galard, Jean-Pierre Casamayou, Jean Dupont, Andre Breand, and Pierre Langereux: "French Naval Air Fleet in the Year 2000"; introductory paragraph in italics as published]

[FBIS Translated Text] *Mastery of the seas is not the purpose of the Naval Air Fleet, whose missions are determined by those of the aircraft carrier to which it is attached.*

Consistency: that is the key word which one notes today in remarks by Vice Admiral Jean Wild, Naval Air Fleet chief—who was interviewed by AIR & COSMOS/AVIATION INTERNATIONAL in connection with this special issue on the Naval Air Fleet at the beginning of the 21st century—and also in the report titled "Tomorrow's Naval Air Group," which was written by Deputy Bertrand Cousin (RPR [Rally for the Republic], Finistere), member of the National Assembly's Committee on National Defense and the Armed Forces. Discussing the modernization of the two aircraft carriers and the carrier aircraft available to the Navy in the 1990's—and, therefore, the technical, financial, and calendar difficulties needing to be resolved to put together a new and credible Naval Air Group—Cousin expresses the same concern: even while making choices, it is necessary to avoid a "break in the consistency of the whole and a loss of operational potential."

What is the makeup of the National Navy's Naval Air Group today, and what is its performance level? In his report, Cousin answers those two questions in detail before describing what the situation will be at the end of the

century if all the commitments made in the planning law now being implemented and in the one to be written in 1997 are lived up to.

Today's Situation

As far as surface ships are concerned, the Naval Air Group still has "old aircraft carriers whose performance is laboriously maintained" and an "escort fleet with satisfactory capabilities."

Having entered active service in November 1961 and July 1963, respectively, the aircraft carriers Clemenceau and Foch will remain in service, following a series of refits, major careening, and modernization programs, until July 1999 (Clemenceau), when the future aircraft carrier Charles de Gaulle will enter active service, and the year 2004 (Foch).

The other surface ships now providing the carrier and its aircraft with air protection (the Suffren and the Duquesne plus the Cassard and the Jean Bart) and antisubmarine protection (five frigates of the Georges Leygues class, with two WG13 Lynx helicopters on board) have capabilities which Cousin describes as "satisfactory." Replenishment for the group is provided by three fleet replenishment ships: La Meuse, La Marne, and Le Var, the latter two capable of operating as replenishment command ships.

Let us move on to the fleet of shipborne aircraft. These are intended to carry out four types of missions: security, reconnaissance, interception, and attack. Based on the nature of their mission (and considering only their operational value, since safety is obviously not an issue), the rapporteur and member of Parliament divides into two

Timetable for Building the Naval Air Fleet

CALENDRIER DE LA CONSTRUCTION DE LA FORCE AERONAVALE																	
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
PORTE-AVIONS																	© Air & Cosmos
Clemenceau 1.																	
Foch																	
Ch. de Gaulle																	
AERONEFS																	
Atlas 2.																	
Nearby																	
Super-Standard																	
Rafale SU-2																	
Crusader																	
Rafale SU-0																	
Standard NP																	
Super Frelon																	
Lynx																	
Panther																	
AN 90																	
FREGATES																	
F70																	
Horizon																	

Key: 1. Aircraft carriers; 2. Aircraft; 3. Frigates; 4. Retrofit; 5. Modernization. (The table above, prepared by the staff of AIR & COSMOS/AVIATION INTERNATIONAL on the basis of the latest information from the Navy General Staff, is not a complete reproduction of the table appearing on page 90 of the Cousin Report. In addition, if the decision is made in 1997 to begin production of a second PAN, that second PAN would appear on this timetable beginning on 1 July 2004, and it would enter active service on the date when the Foch is retired.)

classes the aircraft currently fit for shipboard service. There are those which, from the standpoint of operational capability, give cause for "real concerns," and there are those giving grounds for "relative satisfaction."

For example, he regards the Alize aircraft, which are responsible for security missions, as "outdated," although, he adds, "they will still play an essential role following their modernization." The 15 aircraft still in service today are going to be retrofitted to make them last until 2004, when the Foch is scheduled for retirement.

The rapporteur's judgment is even more severe when it comes to the essential air reconnaissance mission now being carried out by eight Etendard IV-P's that are getting considerable use over the Adriatic Sea and the former Yugoslavia. There is an urgent need to retire them from service in mid-1997. They should be replaced by Super Etendards equipped with a special mount for photography missions. The mount in question has not yet been defined.

As for "interception capability," it is "difficult to maintain," Cousin says. Even when retrofitted, the 17 Crusaders responsible for air defense and air patrol around the carrier group are of an old design (1950). In particular, they have no downward-looking radar capability.

The "relative satisfaction" with the operational ability of the aircraft to carry out the missions assigned to their pilots is due primarily to the modernization of the Super Etendards.

The timetable for modernizing the 54 Super Etendards selected extends from 1992 to 1998. It should be possible to place the first squadron of 14 aircraft in operational service by the end of the year. They will have been completely "rebuilt" halfway through their career with a weapon system that has become truly impressive in its performance. The Navy should receive 12 retrofitted Super Etendards per year in 1995, 1996, and 1997, with the 54th scheduled for delivery at the end of 1998. The Super Etendard will remain "the principal element in the combat force of shipborne aviation" until 2004, when the Foch will be retired, and perhaps a little beyond that date if necessary, says Cousin. Concerning shipborne helicopters, he emphasizes that the Super Frelons, which are used for logistics and special transportation, will be gradually retired from service between 1996 and 2006. The WG13 Lynxes, which are now used for antisubmarine missions, antiship missions, and transportation and medivac missions, will be gradually retired from service after 2004. The six Dauphins used in search and rescue work at sea will easily last until 2010. The Panther was derived from the

Dauphin, and 15 helicopters of that type, delivery of which is occurring between 1993 and 1999, will be based on ship platforms from which they will participate in protection missions against surface ships. They will be equipped not with a missile, although that would have given them antisubmarine capability, but with a single port-mounted 20mm cannon.

Concerning the conventional weapons to be carried on combat aircraft or for use in antisubmarine and/or antiship combat, the deputy makes a very abrupt statement: "They have been sacrificed to benefit priority programs concerned with platforms, aircraft, and infrastructure."

Bertrand Cousin sees positive developments in the future (a light antiship missile for the NH-90 helicopter, a supersonic long-range precision missile in an antiship version and an air-to-surface version, and a new antiradar missile).

Program Totalling 71 Billion Francs

Having thus described the current situation of the National Navy's Naval Air Group on the basis of Cousin's report, it seems worthwhile to present an up-to-date progress report on the overall program for the Naval Air Fleet of tomorrow. In the following pages [not included in this article], our readers will find an interview with Vice Admiral Jean Wild, Naval Air Fleet chief, and articles on the naval Rafale, the command and combat system for the future aircraft carrier, the Naval Air Fleet's future missiles, and a fine cutaway diagram of the E-2C Hawkeye radar aircraft.

Concerning the cost of the Charles de Gaulle, Rafale, and Hawkeye programs (at 1994 prices), it breaks down as follows: development, industrialization, and logistics in connection with the nuclear-powered aircraft carrier (PAN) are estimated at 5.4 billion francs [Fr]; construction of the first PAN is expected to cost 11.8 billion francs; development of the naval Rafale [Rafale M] is estimated at 7 billion francs; construction of 86 Rafale M's is costing 40 billion francs; and the four Hawkeyes are costing 7 billion francs. A total of 71.2 billion francs.

Acquisition of a second PAN, involving practically no development or industrialization expense, would cost 11.5 billion francs.

The final word will still be "consistency," Cousin observes: "Every time a major program is moved back, there is a need to reschedule all the programs. The ease with which an expensive big program used to be smoothed out or delayed is only apparent because of the complex reorganizations to which it leads."

Comparison Between Charles de Gaulle and Clemenceau

Item	Charles de Gaulle	Clemenceau
Displacement	38,000 tons loaded	33,000 tons loaded
Overall length	261 meters	265 meters
Overall width	64.4 meters	51.2 meters
Propulsion:	Power: 83,000 hp	Power: 126,000 hp
	2 nuclear-powered boilers	6 oil-fired boilers
	2 shafts	2 shafts
	Speed: 27 knots	Speed: 32 knots
Stabilization	Yes	No
Crew	1,800 men	2,000 men
Maximum weight of aircraft:	Combat aircraft: 21.5 metric tons	Combat aircraft: 15 metric tons
	Early warning aircraft: 25 metric tons	(17.5 metric tons on the Foch thanks to a mini-ski jump with catapult)
Number of aircraft	35 to 40	35 to 40
Catapults	2 75-meter steam catapults capable of launching aircraft of more than 20 metric tons at 260 km/h	2 53-meter steam catapults capable of launching aircraft of from 15 to 20 metric tons
Elevator capacity	Payload of 36 metric tons	Payload of 12 metric tons
Flight deck surface	12,000 square meters	8,800 square meters
Hangar surface	4,600 square meters	3,300 square meters
Aviation fuel capacity	3,000 cubic meters	1,800 cubic meters
Ammunition capacity	4,900 cubic meters	3,000 cubic meters
Antiaircraft self-defense:	4x8 SAAM missiles	2 Crotale/EDIR launchers
	2 Sadral launchers	4 100-meter turrets

The changes in technical characteristics that appear in this table show clearly that two generations of aircraft carriers are involved.

Source: Cousin Report.

Aircraft Carrier Charles de Gaulle: In Service 1 July 1999

The chief (coordinator) of the PAN (nuclear-powered aircraft carrier) project on the Navy General Staff is Rear Admiral Etienne Biet-Charreton. This is how he sums up the current state of the project:

"The overall program has fallen somewhat behind schedule since it started, but now we need to do everything possible to meet the scheduled date for placing the aircraft carrier Charles de Gaulle in active service, and that date is 1 July 1999. Its entry into active service (ASA) will be preceded, 18 months earlier on 1 January 1998, by presentation of the ship for official sea trials. That event itself will be preceded, on 1 January 1997, by the "acceptance of weapon for trials." That is an important date in that it marks a transfer of responsibility: it is the point at which responsibility for the PAN will pass from the Directorate of Naval Shipbuilding to the Navy. Its captain and crew will take up quarters on board.

"Currently, everything having to do with propulsion is on board. An integration platform assembled in Saint Mandrieu and representative of the 'island' and structure of the aircraft carrier will make it possible through all of next year to refine the combat system, see to it that the computers, radars, and communications and data processing systems

work together in a completely compatible manner, and ensure in particular the smooth operation of the command system (the Charles de Gaulle will be equipped with version 8 of SENIT (system for naval exploitation of tactical data)). After all the systems have been transferred at Brest, trials will continue on the docked ship throughout 1996 and be completed on 1 January 1997.

"It will be difficult to stick to that timetable, but steps are being taken to ensure that the objective is achieved."

France: Ramjet Missile Propulsion System Successfully Tested

BR0203131195 Paris AFP SCIENCES in French
23 Feb 95 p 10

[Unattributed report: "Successful First Test of a Missile Propelled by a Ramjet Rocket Engine"]

[FBIS Translated Text] A new solid-fuel missile propulsion system has been successfully tested at the Landes Test Center, the manufacturer of this ramjet rocket engine, the National Office of Aerospace Study and Research (ONERA), announced on 17 February.

A ramjet rocket is an air-breathing engine (burning the oxygen of the ambient air), which has the advantage of having a low consumption level (it consumes three times

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less than a rocket engine), and, according to ONERA, a low production cost and very simple operation. "Promising" applications are under study at the Matra company.

It has a "nozzle-free" acceleration thruster obtained directly by casting in the propellant block, and a single ignition command begins the succession of acceleration, transition, and cruising phases. The solid fuel of the cruising engine is "autovisible," meaning that it can operate in a very large range of altitude without any regulation system, ONERA states.

The "test missile," propelled by a ramjet rocket of this type, called "Rustic," made it possible to simulate an interception mission (medium-range ground-to-air missile), then an attack mission (air-to-ground missile), as well as evasive maneuvers. The second experimental launch of a missile equipped with this new propulsion system, which would be adapted to future air-to-air interception missiles and future anti-radar missiles, is planned for this year.

Italy's Otobreda Preparing Stealthy Missile

95W50231A Paris AIR & COSMOS/AVIATION
INTERNATIONAL in French 10 Feb 95 p 24

[Article by Jean Dupont: "Otobreda Preparing Successor to Otomat"; introductory paragraph in boldface as published]

[FBIS Translated Text] **Otobreda is preparing a stealthy variant with a range of 300 km for the Otomat antiship missile it coproduces with Matra.**

Otobreda, a subsidiary of the nationalized Italian group Finmeccanica, has announced that it is preparing a new stealth version of its antiship missile Teseo, the Italian designation of the missile being exported in cooperation with Matra under the name Otomat. The new missile, designated Teseo Mk3, could enter service with the Italian Navy in the early 2000's at the same time as the Horizon frigates being jointly developed with France and Great Britain. Otobreda is currently continuing feasibility studies it began in 1991, and according to current projections, development of the missile should be complete by 1998 or 1999.

Although most of the Teseo Mk3's characteristics are still classified, it is possible to extract a certain amount of interesting information about this new shipborne surface-to-surface missile. It differs from the Otomat Mk2 in that its angular fuselage reveals the efforts made by Italian engineers to reduce the missile's frontal radar signature by reflecting hostile radar's emissions in random directions.

The second major improvement is the missile's range, which is being doubled. It is up from approximately 160-180 km to over 300 km. That improvement was apparently achieved by making the missile 1 meter longer to enable it to carry more fuel and by making it thinner. To accomplish that, the span of its fins has been increased and their sweep angle reduced. Lastly, to reduce the turbine's

fuel consumption, a trade-off affecting the speed of the missile had to be found. The missile will fly at a high subsonic cruising speed and receive terminal acceleration in order to attack at transonic speed with great maneuverability enabling it to escape cannonfire, whereas the current Otomat is said to be transonic throughout its trajectory.

The Teseo Mk3's guidance system also constitutes a definite improvement over its predecessors. For its cruise phase, the missile will add to its strapdown navigation system a course correction capability using GPS [Global Positioning System]. For its terminal phase, the current fuze, which operates on impact, by grazing, or by proximity, will give way to a double (radar plus infrared) homing head. The purpose of that new solution is to make the missile resistant to current and future countermeasures deployed by ships (thinking in particular of staggered active decoys). As an extra, the Teseo Mk3 will also possess countermeasure capability against antimissile missiles.

According to Otobreda, the effectiveness of the Teseo Mk3's terminal guidance system should make it very effective in attacking coastal targets and even ships hiding in a bay. Lastly, the Teseo Mk3 will probably retain the two additional solid-propellant propulsion units used by the Otomat Mk2. Those units provide its initial propulsion and are responsible for its ability to gyro-angle up to 200 degrees at launch. That will make it possible to retain the current solution using a fixed launcher on the ship's bridge.

Belgium: Dassault's Involvement in Bribery Scandal Alleged

95P60127A Paris LE MONDE in French 8 Mar 95 p 5

[Unattributed article: "Dassault Accused of Having Paid Bribes in Belgium"]

[FBIS Translated Text] Brussels. According to Flemish press reports, the French Dassault corporation is also to be implicated in the bribery scandal for paying "commissions" to the French Socialist Party (SP) in exchange for securing arms contracts. On Tuesday, 7 March, the daily DE STANDAARD reported that on the previous day a search had been made of Dassault Construction headquarters in Brussels. Luc Wallyn, one of the recently arrested individuals during an investigation focusing on the under-the-table "presents" given by the Italian firm Augusta for a helicopter deal in 1988 in Belgium, was also involved in a 10-million franc transfer to an SP intermediary in 1989. According to rumors, Aerospatiale—an Augusta competitor—was also involved in the helicopter deal. But since the money transfer this time did take place after the contract was signed, the case appeared somewhat murky. On the other hand, as the Flemish press report emphasizes, in 1989 Dassault picked up a contract for modernizing the electronics of the Belgian air force's 72 F-16 fighter bombers, as well as for refurbishing 20 Mirages. The justice authorities have been silent on this part of the investigation.

France: Biological Pesticide Developed at Pasteur Institute

95WS0211C Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 2 Feb 95 p 8

[Article by b.h.: "Biological Pesticides from Sporeless Bacteria"]

[FBIS Translated Text] A strain of bacteria which is no longer capable of forming spores can be used in the production of the biological pesticide Btx. In contrast to the classic form of the toxin-producing bacterium *Bacillus thuringiensis*, the spore-free form can, among other things, be cultivated in a continuously operating fermenter.

With 90 percent [of the market], Btx is the most used bio-insecticide. The poison is usually applied protectively to the plants along with the bacteria. This means that usually countless numbers of spores capable of germinating new bacteria are also being released outdoors. The use of bacterial preparations containing Btx and with viable spores is therefore forbidden in various countries. Scientists at the Pasteur Institute in Paris (Unité de Biochimie Microbienne, URA 1300, 25 rue du Docteur Roux, 75724 Paris) have now discovered a mutant form which is incapable of sporulation.

The spore-free bacteria happen to have another advantage: they store considerable amounts of the toxin in the space between the cell wall and the cell membrane. Large crystals form which also remain enclosed by the biomembranes. They are quite stable, because they are not attacked by proteolytic enzymes. When they are applied to a field, the cell shells then slowly release the insecticide.

Germany: New Technique Measures Potential Changes in Dams

95WS0205C Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 17 Jan 95 p 8

[Article by eka: "Potential Change Indicates Break in Dam"]

[FBIS Translated Text] Frankfurt—A measurement procedure has been developed at Karlsruhe University which can detect leaky spots in dams and dikes at an early stage. It is based on potential measurement, the geoelectric process of the charging method: the electrical conductivity in the dam embankment changes with the entry of water into the sealing system.

To be sure, materials used for sealing purposes such as clay, asphalt concrete, cement concrete, steel and synthetic foils have very different conductivity values. The Institute for Soil Mechanics and Rock Mechanics (Professor Josef Brauns) has therefore, together with the Institute for Applied Geology and the Federal Institution for Hydraulic Engineering, studied a model of a dam by making tests in an excavated pit at the federal institution's site in Karlsruhe. As a sealing element a plastic facing was applied to the slope of the dam on the water side. This facing was then pierced for the experiments. From studies in the laboratory and of the dam model it was shown that the sealing

plastic facing, which consists of a material with electrically insulating properties, offers very good preconditions. With appropriately designed measurement equipment it is possible to locate leaks, in particular with measurements from the water side of the dam.

For sealing elements from other materials such as steel or concrete, interpretation of the results is not unequivocal, however. Additional studies are needed here in order to arrive at the charging method. To conclude the project intended to last three years there are plans to demonstrate the capabilities of the method with an actual case of application.

The method is being developed above all because stationary observation facilities such as for dams and for dams along rivers would be disproportionately expensive. For that reason the goal here is a more economical permanent monitoring.

Siemens Develops Highly Efficient Gas Turbines

95WS0206C Duesseldorf VDI NACHRICHTEN
in German 3 Feb 95 p 21

[Article by Klaus Jopp: "Gas Turbines Turn Up the Efficiency"; first paragraph is editor's summary]

[FBIS Translated Text] Berlin, 3 Feb (VDI-N)—It took Siemens several years of developmental work and about 200 million German marks [DM] to develop a new family of gas turbines. Because of the high efficiency level, the manufacturer considers them particularly suitable for use in combined gas and steam turbine power plants, which are currently undergoing a worldwide boom.

Siemens is boasting of a world record in efficiency, the measure of all things in power plant construction, for its new family of gas turbines of the 3A series—a record which points the way of the future. The electronics company has a testing facility at its disposal in its Berlin plant on Huttenstrasse which makes it possible to run tests under power plant conditions. Here the first machine, a V84.3A for the American 60 Hz market, was tested for soundness. Expectations for power and efficiency were exceeded: the measurements yielded values of 170 MW and 38-percent efficiency in solo operation.

"The 3A generation of gas turbines, covering a spectrum of 70 MW to 240 MW, sets new standards technically and economically," explained Dr. Bernard Becker, director of gas turbine technology for Siemens/KWU, at the presentation on 19 January. The test results point to an efficiency rating of at least 58 percent when used in combined gas and steam turbine power plants (GUD power plants), an improvement of about 4 percentage points over the previous level and an international record. According to statements from Siemens, there are no similar results from competitors. "Every percent of improvement in efficiency level means savings of DM60 million-DM100 million," as Dr. Hans Boehme, member of the divisional governing board for energy production (KWU), emphasizes.

The development of the turbines, which cost about DM200 million, began in 1990. At that time Siemens signed an agreement with the engine manufacturers Pratt & Whitney (United Technologies, U.S.) for an exchange of

technology which has since then been transformed into a 15-year contract. "We used the experience of our partners especially in the arrangement of the condensers, in the aerodynamics in general, and in effective cooling of components under particular thermal stress," explains Becker.

One of the most important new construction characteristics of the 3A family is the compact combustion chamber with 24 hybrid burners which are arranged in a ring in front of the first turbine level. When natural gas is used, this arrangement should guarantee a particularly low nitric oxide emission of less than 25 ppm of NO_x per cubic meter of exhaust gas. To provide a high level of maintenance friendliness, the combustion chamber has two manholes which makes it possible to inspect the parts of the machine which conduct heated gas, i.e., all the burners, the entire flame area, and the first level of the turbine vanes.

As a further innovation, the four-level turbine was given complete vanes made of single crystals of a patented nickel-based coating from P&W, which possesses a higher proportion of chromium in comparison with flight motors. This modification is necessary, because in running a factory fuels with higher pollutant levels are used. The temperature at which the turbine was activated was raised to 1,190°C. At the same time the air cooling of the vane profiles was improved by film cooling. "This process has proved itself in jets which work with significantly higher combustion temperatures," is Becker's expert comment on this borrowing from airplane construction.

With the new gas turbines, Siemens is entering into competition not only with the American world market leader General Electric (GE), but with their rivals, Asea Brown Boveri (ABB). In September of 1993 the company ABB Kraftwerke AG in Mannheim, along with its parent company in Switzerland, had already introduced the new development of the GT26/24 for 50 and 60 Hz electrical networks, which was also said to achieve efficiency levels of 38 percent in solo operation and 58 percent in combined operation. However, ABB relies on a different conception of two-stage combustion with an intermediate overheating technique.

The efforts to achieve a better gas turbine have an obvious economic background. Because of their advantages in degree of efficiency, in environmental friendliness and their relatively low investment costs, the construction of combined gas and steam turbine power plants will increase all over the globe.

In this year alone capacities of about 25,000 MW are being installed. In the next ten years, experts count on a further stable increase in combination plants. "With the increasing optimization of gas and steam turbines and of all the process parameters, our GUD power plants will have an efficiency level of 60 percent by the end of the decade," prophesies Albert Kreutzer, chief of operations for fossil-fueled power plants for Siemens/KWU.

Siemens already has six contracts for the 3A types. For example, the major power plant at Tapada do Outeiro (Portugal) is being equipped for a total output of 990 MW with three gas turbines of the V94.3A types (each 240 MW) and a steam turbine. In Altbach-Zeizisau the Neckar works

in Esslingen want to operate the first compound power plant in the world (410 MW) with a superposed V64.3A gas turbine (65 MW).

The great gainer from the competition for higher efficiency levels and improved combustion technology is the environment. Besides the significantly low nitric oxide emissions, the production of carbon dioxide, which is relevant for climate, is being reduced. When the recently introduced gas turbines and the GUD technology associated with them are used, the specific CO₂ emission per kilowatt hour drops by almost 80 percent in comparison with natural gas power plants from the 70's—good reasons for a further triumphal march of the gas turbines. While between 1985 and 1989 the share of GUD units in fossil power plants worldwide was only 12 percent, now it has already reached 37 percent.

FRG's Merkel to Promote Environmental Technology

95WS0214C Duesseldorf *HANDELSBLATT* in German
9 Feb 95 p 3

[Article: "Merkel Willing to Support 'Eco-Technology for Future'"; Subhead: "ERP Credit Volumes Again at High Level"]

[FBIS Translated Text] Bonn, 2 February 1995—In 1994, one of every four marks from the European Reconstruction Program's (ERP) special fund weighing in at 4.3 billion German marks [DM] went to support product-integrated environmental technology. Federal minister for the environment, Angela Merkel (Christian Democratic Union (CDU)) observed that the support volume therefore virtually doubled compared with the DM2.4 billion in 1993.

In 1995, too, "preventive environmental protection" in particular is being supported. This is better "than using costly downstream clean-up technology to again rid the world of environmental pollution once it has originated." For 1995 the environmental minister deems especially deserving of support also private sector investments in natural-gas operated vehicles and service stations. In such instances the ordinary upper limits of financing for ERP environmental lending could even be stretched by 50 percent.

Veit Poepping of the federal ministry for the economy estimated that, all told, in 1994 the federal government provided DM11.5 billion to support investments in environmental protection. Hans Koban, member of the board of the German Settlements Bank (DTA), Poepping and Merkel, confirmed that this volume would be on standby, for example, even in 1995.

Topping the hot-button list of projects meriting support also are investments in the wake of the implementation of the eco-audit. As a result, incentives should be offered to firms to voluntarily realize environmental management. Merkel hopes quickly to turn into legislation the compromise in the eco-audit sealed on Monday. Meanwhile the BUND voiced criticism of the allocation of seats on the committee of experts, with the private sector getting twice as many votes as the eco-groups.

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In 1994 Merkel's ministry supported more than 3,200 environmental projects with reduced credits via the DTA. DM2.3 billion alone went to the new laender where there continues to be a considerable need to catch up on investments to protect the environment.

According to Merkel, of the total amount, DM1.7 billion went for investments in energy savings. Merkel recalled that, in terms of numbers, the annual energy savings just for manufacturing plants with supported energy savings in

1994 were the equivalent of five times the demand for energy by the city of Bonn. Activities for the use of renewable energies also would get high priority.

At DM1.1 billion the volume of support for keeping the atmosphere clean also more than doubled. DM900 million went to the waste sector and DM600 million were allocated to waste-water purification. Altogether, the minister assessed the additional investment amounts as "signaling the upturn in the economy."

European GEM Project Seeks to Automate Product Design

95WS0211D Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 2 Feb 95 p 8

[Article by r.w.g.: "GEM to Automate Product Design. Finite Element Grids Generated According to Production Requirements"]

[FBIS Translated Text] A group of European companies has been working since mid-1994 on a project which is supposed to simplify the design process and make it more effective. The "generic engineering analysis model" project, GEM for short, is concerned with the transmission of technological models of analysis as database and archives. The ESPRIT [European Strategic Program for Research and Development in Information Technologies] project, which is funded with 4.2 million ECU, is supposed to improve the competitiveness of European industry.

The attempt is being made within the scope of the GEM project to free the designer from the domain of specialization. In the future, for example, the designer working on the lid of a car trunk should no longer also have to have to keep his eye on the finite element grid of design points. Instead, he should be able to concentrate on designing his component to be attractive and functional.

His "toolbox" contains the tools he needs to help him with his design. Then if he has to know whether the lid holds up, whether it can also be made by injection molding, whether and how it holds up in a crash test and whether it makes too much undesirable noise when the car is in motion, then the designer himself should not have to employ any methods of analysis, but rather he should be able to get the desired findings at the push of a button.

The designer must naturally formulate the problem of where what load is applied. But everything else should be calculated and answered automatically by any system, in the opinion of the companies participating in the GEM project. With GEM, analysis is integrated into the design.

For years, design and computer experts have lived together without really communicating closely with each other. The GEM project wants to have a better integration of analysis into design. For example, the auto industry is very interested in GEM with regard to shortening prototype running times. The airline industry is also very interested in this new method.

The finite element grids, which allow the relationship of components to be described with adequate precision, are only generated automatically based on the descriptions of the tasks or problems. With the new method which the GEM project is working on, the findings regarding the described task or problem should be able to be fed back. This would, for example, make it possible to find a simple, lucid, clear way even to design variants. This has not been possible up to now.

The project is to be wrapped up in three years. The next steps involve making up a kind of applications protocol. Then there should be prototype implementations, as Dr. Helpenstein of the GIS in Aachen says, who, with Dornier

in Friedrichshafen, makes up the German participation in the GEM project. These will then show with that the exchange is possible, Helpenstein affirms.

Ten more European manufacturers are working together in the project group under the direction of Nafems, Glasgow (Great Britain). Presumably a single company would hardly be able to afford and finance such developmental work. Also, there is the argument that it is hard to get industry to accept system interfaces and standards developed by an individual company, which makes development risky.

Germany: Laser Sintering Improves Rapid Prototyping Process

95WS0206B Duesseldorf VDI NACHRICHTEN in German 3 Feb 95 p 15

[Article by Wolfgang Fili: "Laser Sintering Optimizes Prototype Construction"; first paragraph is editor's summary]

[FBIS Translated Text] Duesseldorf, 3 Feb (VDI-N)—The company DTM Deutschland GmbH in Hilden hopes to find a quick path to mass production using its "selective laser sintering" process: prototypes for model construction which are produced by this variation of rapid prototyping can be subjected to mechanical stress and permit rapid functional tests in advance of production.

Klaus J. Esser is convinced that it is not only "rapid prototyping" which interests companies today, but rather "rapid manufacturing," i.e., the rapid production of many functional patterns for product development. He says that only such patterns permit the model to be tried out, tested and studied to the last degree of certainty to find out whether it meets specifications.

Klaus J. Esser is the head of sales for DTM Deutschland GmbH, with headquarters in Hilden. The abbreviation in the name stands for Desk Top Manufacturing. The parent company is in Austin, Texas, and was created in 1986 as a spinoff from the University of Texas in Austin.

What distinguishes DTM's "selective laser sintering" from other rapid-prototyping processes, according to Esser, is that models "display mechanical properties which they need for serious functional testing."

As in stereolithography, at DTM the model geometry is first obtained using a three-dimensional CAD [Computer-Aided Design] data set which describes an enclosed volume—the STL format. This is then broken down into cross-sections with thickness between 0.1 mm and 0.3 mm. The vector pattern produced in this way is used to steer a CO₂ laser which passes over a pan filled with heated granules, melts them and thus builds up a thermal image of the desired geometry layer by layer. The pan is then lowered bit by bit and a new layer of sintering powder is added. The process manages without any mountings or similar arrangements, since in the powder bed even the most complex bodies are suitably supported on every side. Even special geometrical cases like undercutting, islands or projecting portions can thus be realized without further expense. The rate of construction is between 10 and 30 mm per hour. Then the unused powder is sifted and can be reused. Thus there is virtually no waste.

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The measurement tolerance of the parts depends on the geometry, but generally it is around plus or minus 0.125 mm to 0.25 mm. As Esser says, "Unlike traditional rapid prototyping processes, the finished model here is a homogeneous and practically usable part." The reason is that in Hilden polyamides and polycarbonates are generally used in laser sintering.

According to DTM, polyamides achieve 80 to 90 percent of the mechanical properties necessary for functional models and prototypes and can withstand operating temperatures of up to 120°C. But with granulation of up to 0.1 mm they are very rough on the surface. In elasticity the prototypes resemble injection-molded models, but without as much compressive strength. The time required by the process is between 2 and 10 hours, and the subsequent cooling requires about 1 hour.

Polycarbonates are used for porous visual and demonstration models which undergo little mechanical stress. The prototypes can be made with thinner walls and finer details than in the case of polyamide models. When the models are filled with epoxy resin and polished, more durable geometries can also be constructed. The cooling off needs only about 20 minutes because of the porosity. Polycarbonate models are also well suited to serve as lost models for casting technology (firing).

The depth of roughness of the two materials is between 15 micrometers (polycarbonate) and 100 micrometers (polyamide). There are currently 45 DTM machines in use in

the U.S., 5 in Europe. Each costs between DM500,000 and DM900,000. In all cases the cooling period is reportedly well under an hour.

Klaus Esser can picture companies from the fields of automobile construction, consumer goods, electronics, air and space travel, medical technology and metal casting as typical users of laser sintering. But it must first be established that there is an actual need for it, that time, costs and time-to-market have been acknowledged as critical factors and that 3D-CAD is used consistently in construction. In addition, there should already be experience in modeling and secondary processes.

DTM expert Esser sees stereolithography—i.e., the photo-optical rapid prototyping process—as direct competition only in particular cases, since "for surface quality it is still unquestionably superior to the sintering process. The particles are finer and can be applied much better." In his opinion, what is important for users is examination of the individual case, including an evaluation of the strengths of the two methods. For identical objects he believes that this would be possible using two criteria: one would be if polyamide models make an extensive mechanical simulation of subsequent function possible (catches or camera hinges, even intake bends for automobile carburetors), are to be made in relatively economical limited production and may exhibit rough surfaces. On the other hand, the smoothest possible surface might be important. In that case, he says that stereolithography is preferable.

Germany: Interim Report on Photonics R&D

MI2202153095 Bonn *TECHNOLOGIE-NACHRICHTEN*
MANAGEMENT-INFORMATIONEN in German
29 Dec 94 pp 8-9

[FBIS Translated Text] As a system technology, photonics constitutes a symbiosis of electronics and optics. Photonic systems consist of elements drawn from (micro)electronics, optoelectronics, and conventional optics in an integrated and miniaturized form. They provide particularly fast data transfer and will take over from purely electronic systems in the future.

Modern communications systems are largely based on fiber-optic links that use light to transfer information. World communication links have been created almost exclusively in fiber-optic technology since as early as the mid-eighties, but the technical potential of photonics far exceeds applications of this sort. For instance, photonics sets out to exploit advances in optoelectronics and micro-optics to open up long-term prospects making for fully optical system solutions, for example for switching.

It is now acknowledged worldwide that photonics holds out high future potential that may pave the way for technical breakthroughs and lead to completely new information systems. The BMWFT [Federal Ministry of Education, Science, Research, and Technology] has thus been funding research and development projects on the subject under its Information Technology Funding Strategy, involving the participation of private industry, research facilities, and universities, since 1990.

Two joint projects, one on "Optical Signal Processing (OSV)" and the other on "Optical Link Technology (OVT)," have been carried out in an initial four-year stage of the Photonics funding scheme. Both these projects set out to investigate the potential of photonics for information technology and to demonstrate it in selected representative experimental systems.

Whereas the OSV consortium basically had its sights set on optical link technology [as published], the OVT consortium's primary objective was the integration of optical links into an electronic environment. The original 32 individual projects were joined in the course of 1992 by additional research projects in the new federal laender, the inclusion of which in the work in process contributed to the rapid integration of the universities and newly established research facilities into the optoelectronics and photonics research scene.

The results of the initial stage, which the BMWFT funded to the tune of approximately 95 million German marks [DM], have now been announced. Remarkable achievements have been made as regards key photonics components, including surface-emitting laser diodes. Lasers of this type can be produced in a matrix-shaped configuration and are ideal for free-beam optical connections in an extremely confined space. As they make for high packing densities, a particular feature of these components is their low power dissipation. The surface-emitting lasers developed by researchers at the University of Ulm lead the international field in this respect and are of particular interest for optical link technology.

The Fraunhofer Institute of Applied Solid-State Physics (IAF) in Freiburg has developed laser diodes specifically for optical transmission purposes. The 30-GHz modulation bandwidth demonstrated in these laser diodes exceeds even Japanese and American achievements. This high bandwidth makes it possible to transmit optical signals at a speed of 35 billion bits per second, with the result that, for example, 250 HDTV [high-definition television] quality programs can be broadcast over a single optical fiber at the same time.

The IAF also achieved another world record with an optoelectric receiver designed as a monolithically integrated circuit (OEIC [optoelectronic integrated circuit]). The gallium arsenide-based circuit, which consists of a photodiode and a two-stage amplifier, is capable of receiving optical signals at transmission rates up to 20 Gbit/s.

A major contribution has been made by the Heinrich Hertz Institute (HHI) in Berlin, which has recently presented a world first in the form of a glass fiber cable tuner chip only a few square millimeters in size. It has been proved that it is technologically feasible to series-manufacture a highly complex monolithically integrated optoelectronic component of this type, the production of which involves 170 individual process steps. This is a milestone along the road to the mass production of key photonic components, such as those required for economic links to the future "fiber-optic data highways."

As this and numerous other examples show, the high potential held out by photonics for information technology has been demonstrated and a major springboard has been created to help the German telecommunications industry maintain its strong position. The orientation of the funding scheme has also proved correct from the international point of view, and close cooperation has sprung up between universities, research facilities, and industry and is set to continue over the coming four years. The BMFT [Federal Ministry of Research and Technology] [as published] will be funding about 40 photonics projects in this second stage to the tune of approximately DM 110 million.

The projects will build on results to date and show a stronger bias toward the promising application prospects emerging in information technology and telecommunications. Focusing the research work on specific target systems will also enhance the interplay between technology and system development, thus creating productive synergies.

The targets include the development of information systems for 40-Gbit/s, and subsequently 100-Gbit/s, transmission rates, optical fiber amplifiers for hitherto unattainable wavelength ranges, and optical switching networks for use in, for example, setting up and expanding a data highway infrastructure. Another major topic is massively parallel optical connection systems, which can be used in all areas of computer engineering.

The core projects are flanked by projects that set out to develop and provide the requisite technologies, key devices, components, and subsystems.

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In the future, photonics will effectively complement electronics in many areas and supersede conventional, purely electrical communications. It will be used everywhere where electrical processes come up against the limits of their technical and physical capacity or are more expensive.

Germany: Volkswagen Foundation Funds Nonlinear Optics Research

MI2302100995 Bonn *TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN* in German
29 Dec 94 pp 9-10

[FBIS Translated Text] Nonlinear optics (NLO) has been taking on increasing importance since it was recognized that NLO phenomena, such as frequency doubling, optical rectification, and the electro-optical effect, are ideal for creating light-activated devices for communications technology. In addition to work on improving these devices themselves, increasing interest is currently being devoted to the development of materials with improved nonlinear optical properties. The Volkswagen Foundation has made a grant of 126,300 German marks to the University of Hannover Institute of Macromolecular Chemistry (Professor M.L. Hallensleben, Dr. H. Menzel) to develop materials of this kind.

The main purpose of the project is to produce organic coatings with nonlinear optical properties from one layer of molecules, at the same time minimizing optical losses. The coatings are to be the same thickness as the light wavelength, i.e., they will be comparatively thick for monolayers. The desired orientation of the macromolecules perpendicular to the substrate surface is to be achieved by using rod-shaped polymers and anchoring them to the surface via a chemical reaction. The energy released by this reaction constitutes the driving force for a sufficiently high coating density. Using polymers ensures that the resulting monolayer achieves a thickness matching the light wavelength. If the molecules in the monolayer have a high level of hyperpolarizability, the monolayer should present nonlinear optical effects.

Polypeptides, in other words macromolecules consisting of natural amino acids, are of particular interest in this connection, as they meet the requisite stability specifications and present a high degree of hyperpolarizability. However, NLO-active films cannot be obtained unless the molecules are oriented, for instance by precipitating a polypeptide film from a solution under the influence of an electrical field. Another way of orienting the molecules, and this is the method used here, consists in the specific binding of the rods to a surface.

The silicon surface has to be functionalized in order to bind the polypeptides. An oxide layer that carries hydroxyl groups is first produced in a purification process. What are referred to as silanization reagents react with these groups to form new amino groups capable of reacting with the polypeptide on the surface. There are many methods for actually binding polypeptides to these functionalized silicon surfaces, and they are being studied in terms of their suitability.

In order to keep optical losses low, surfaces with the maximum possible smoothness are to be obtained by coating them with polypeptides of approximately the same length. The scientists in Hannover are thus planning to divide the polymers, which are prepared according to the conventional method, into fractions of the greatest possible uniformity prior to coating, and to use flexible polymers at one end of the polypeptides to even out any residual differences in the lengths of the polymer rods.

Further information is available from Professor M.L. Hallensleben and Dr. H. Menzel of the University of Hannover Institute of Macromolecular Chemistry, tel. +49-511-762-5144/5971.

Germany: Laser System Sorts Materials Upon Reprocessing

95WS0211A Frankfurt/Main *FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT* in German 31 Jan 95 p 8

[Article by Roman Maksymiw: "New Methods Permit Plastic To Be Sorted Before Reprocessing. Laser Beam Produces a Characteristic Plasma. Testing of Heat Radiation. pH Value Shows Differences. Trends in Patent Applications"]

[FBIS Translated Text] Munich. In view of the enormous growth in waste revenues, the reprocessing of plastics is gaining in importance. Currently, packaging certainly creates the greatest problem in this area. In addition to the huge amount of waste, this also is due to the accumulation of various old plastics of differing quality. This makes an evaluation of the plastic waste materials substantially more difficult.

The situation is better in the automobile and electronics industries, as examples. Here, usually only a few types of plastics are used. Currently, it is required for the reclamation of high-quality materials that they be sorted by type as cleanly as possible. While the price of new plastics depends to a considerable degree on fluctuations in the oil market, the price of recycled products is primarily determined by the economic constraints of whatever reprocessing method is used.

Automated sorting methods are necessary in order for plastics to be reclaimed profitably. Manual separation is precluded because of the generally high waste revenues and, thus, the high labor costs associated with them.

A fundamental component of automatic sorting systems, as described for example in the German published patent application DE 41 05 586 A1 or in the American patent documents US 5318 172 and US 5150 307, is the metrological recording and identification of the individual plastic materials. The resulting measurable variable is used to control the separation equipment.

Methods which currently play a prominent roll in the patent literature are those in which the plastic materials to be classified are first degraded down by heat and then identified through analysis of the breakdown products.

As an example, the German published patent application DE 42 00 497 A1 describes a method for quickly identifying plastics in which the plastic test sample is heated locally by a laser beam to a temperature of between 600 and 800°C and the resulting plastic-specific breakdown products are then analyzed using a mass spectrometer.

One radiation source is an ND:YAG laser which produces light with a wavelength of 1,064 nanometers. The laser beam is directed to the plastic sample by means of an optical fiber waveguide. This waveguide is surrounded by a dissector tube which is connected to an inert gas source. Protective gas can thereby be supplied to the plastic surface in the area of the laser's cross-over point, which prevents oxidation of the plastic.

The material-specific compounds released by heating the surface of the plastic are drawn away by a capillary leading to the mass spectrometer. Heating the extraction capillary insures that no breakdown products are lost on the way to the spectrometer because of condensation.

In another process, to simplify metrological recording of the types of plastics, a reading is taken of the pH of the steam produced in the thermal degradation [of the material] induced by a carbon dioxide laser (DE 42 38 692 A1). This process is based on the fact that the breakdown products of halogenated plastics are strongly acid, of polyamides strongly basic, and of all other plastics for the most part neutral.

Measuring the pH of the breakdown products [which result from the application of heat to the original material] is also proposed in the Japanese patent application JP 6-102185 A concerning the identification of polyvinylchloride (PVC). In this process, the plastic surface is heated locally by contact with a hot spray instead of by a laser.

Other identification processes make use of the characteristic temperature behavior of various plastics in terms of their reaction to being heated. If, for example, an amount of plastic is subjected to a high-frequency field (such as in a microwave chamber) for a specific time, the individual plastic materials are heated unequally, since the dielectric loss factor of the plastics depends on their composition. With a quick-response pyrometer, the unequally warm plastic pieces can be classified and automatically sorted (DE 40 21 882 A1).

Another process suitable for identifying plastics and based on characteristic temperature behavior is described in published patent application DE 43 01 987 A1. Here, the plastics are heated locally with a pulsed laser beam; after the excitation pulse, the characteristic temperature increase is among the factors which are measured.

In addition, measuring the positional and temporal course of heat irradiation is another way to quickly identify various types of plastic (DE 42 39 479 A1). After a brief,

point-shaped heating of the plastic materials with a pulsed laser beam, a thermocamera records a frame sequence of the locally heated plastic surfaces. From this and using digital image processing, it is possible to determine the rate of cooling in the heated area and the advance of the heat front over a specific surface area.

One analytical technique which has been in widespread use for many years in the area of plastics analysis is infrared spectroscopy. As one example of this, the composition of plastic mixtures can be determined by establishing the infrared transmission spectra on thin plastic samples; the accuracy of the measurement can be increased by rotating the samples while recording the spectra (DE 40 36 201 A1).

Plastics can also be identified by irradiating them with infrared light and measuring the intensity of the transmitted or reflected radiation at specific wave lengths (DE 42 05 630 A1, DE 43 12 915 A1).

In addition to spectroscopy in the infrared portion of the spectrum, the reflection behavior of plastics in the range of ultraviolet radiation provides a way recognizing different plastics. For example, characteristic reflection spectra can be determined for the range between 320 and 430 nanometer (UV-A radiation), and from their total intensity it is possible to identify the plastic material in question.

Finally, another focus is with those processes in which plastic particles are irradiated with short-wave light and a characteristic distinguishing trait is generated from longer-wave radiation emitted by the plastic.

To identify large amounts of accumulated plastic particles of varying kinds quickly, there is one type of process which involves placing the separate particles one after another in a sorter and transporting them in front of a pulsed UV light source, such as an excimer laser, where they are briefly irradiated. A spectrophotometer records the fluorescence or Raman spectra. The various kinds of plastic can be identified on the basis of the intensity of the emitted radiation at given wave lengths (DE 41 02 767 A1).

It is also possible to identify a material if a plasma is generated from the light energy in the focal spot of a laser beam focused on the surface of the plastic. The light emitted from this plasma is characteristic for the respective type of plastic. It is recorded with an optical waveguide and analyzed in a spectrophotometer (DE 40 04 627 A1).

The number of German patent registrations in the area of metrological identification of plastics has risen significantly since 1990. These registrations come from major groups of companies, from small and mid-sized business as well as from individual inventors. This underscores the immediacy and importance of measurement technology for the reprocessing of plastics.

The author of this article, Dr. Roman Maksymiwi, is a member of the German Patent Office in Munich.

Germany: Polymer Light Diodes Change Colors of Materials

95WS0211B Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 2 Feb 95 p 8

[Article by o.e.l.: "Polymer Light Diodes Change Colors. But the Light Diodes Are Not Yet Sufficiently Stable Over the Long Term"]

[FBIS Translated Text] At the University of Linköping (Laboratory of Applied Physics, S-58183 Linköping), they have recently succeeded in changing the luminous colors of polymer light diodes through nothing more than changed voltages. The goal of the developmental work is multicolored, flat electroluminescent displays and, in particular, lightweight video screens for portable computers.

A large number of variously colored light diodes could be produced as pixels in the size of video screens, possibly in an easy to control printing technique. So far two-color light diodes have been produced successfully which can change their emitted light between the colors of red and blue or green and red by just altering the fed voltage.

Thiophene polymers are used for the light diodes. Thiophene here forms the backbone of a polymer on which the various side chains are hung—these, then, are responsible for producing the color. A large group of organic compounds already exists for this. The main job now is to hang them at the right place and in the right amount on the thiophene chain. Since this cannot be calculated in advance and simulated, many experiments are needed to test out the right amounts and positions for the color side chains.

The average life span of the polymer light diodes is not yet known. Their cycles have still not been determined. It has, however, been observed that brightness and color change become weaker with increasing operation time. Thus, appropriate methods must still be found for stabilizing them sufficiently for several years of use. With continuing progress, such polymers could replace semiconductor materials, because they are easier and therefore cheaper to produce.

German Researchers Develop CMOS Technology Image Sensor

BR2202161395 Paris ELECTRONIQUE
INTERNATIONAL in French 9 Feb 95 p 34

[Report by Elisabeth Feder: "The Electronic Eye Becomes a Reality"]

[FBIS Translated Text] Stuttgart—An image sensor developed by a team of researchers at the Stuttgart Microelectronics Institute has such good luminosity and contrast analysis specifications that real electronic eyes may soon become economically feasible. This image sensor, christened HDRC (High Dynamic Range CMOS chip) consists of a network of light-sensitive cells using standard 0.8 micrometer CMOS technology which therefore suggests that this is an economically viable solution. Its dynamic range (The dynamic range or the contrast refers to the ratio between the brightest point and the darkest still-distinct

point of an image) is 250 times more than that obtained by standard and much more expensive CCD's, thanks to a contrast analysis capacity based on logarithmic compression. Moreover, random access to the pixels as opposed to the sequential access used by CCD's enables fast and selective detection of parts of an image thus increasing the field of applications. This sensor can already be produced industrially and the first prototypes providing a resolution of 256 x 128 light-sensitive pixels have been manufactured by IMS which has its own clean room, as well as by Siemens and ITT Semiconductors. A 512 x 256 pixel version is currently being developed. Color rendering looks likely before 1997 (the work of the IMS was done in the framework of the Prometheus project—part of the European EUREKA program). An initial version of the image sensor was produced in association with the car manufacturer Daimler-Benz in the context of a project for an optically-steered car (OSCAR). Produced using 1.2 micrometer CMOS technology, this version had 64 x 64 pixel resolution. This sensor could be used in the fields of security, quality assurance, transport, character recognition, and multimedia.

Detecting Differences in Contrast of 5 Percent

Beyond a certain contrast the light-sensitive elements (pixels) of an image sensor reach saturation point resulting in "blooming" and whole portions of the image become indistinguishable. With a standard CCD this blooming generally occurs from a dynamic range of 4,000. The HDRC, on the other hand, can receive an image with a contrast ratio of one million (thus 250 times more) without pixel saturation thanks to the logarithmic compression of the signal arriving at each pixel. This compression could be compared somewhat to the compression done by the human eye which is capable, in the best conditions, of discerning differences in contrast of 1 percent; the IMS sensor is capable of detecting differences in contrast of 5 percent (see chart [not reproduced]).

The HDRC is composed of two networks of 128 x 128 pixel light-sensitive cells. The pixels are located on an orthogonal grid and pitched at 36 micrometers. They have a local processing unit which allows random and selective access to each pixel. This is particularly useful for image processing systems and makes it possible to reduce the volume of data to include just the significant image data. This data can thus be sent over narrow bandwidth communication networks (for example, a twisted pair telephone network or a domestic serial data processing line). The cell addressing structure is similar to that of memory cells, using a 15-bit address bus (switching to a 16-bit bus would make it possible to design a 256 x 256 pixel sensor). Output signals pass through two differential ports. The circuit can supply up to 420 complete images per second (14 million pixels per second). Pixel access time is 140 nanoseconds. The pixels' brightness sensitivity ranges from 10 mW/m² to 10 kW/m².

In addition, the IMS is working on an image processing system to be unveiled next spring which comprises, on a credit card format printed circuit, an HDRC sensor, an 8-bit analog-to-digital converter, a configurable raster processor (also developed by IMS), a ROM chip, and a lens.

This system, christened Omnivision, is equipped with an IRCC-standard TV interface.

Germany Russia: Cooperation in Nuclear, Oil-Gas Technology Explored

95WS0213B Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 9 Feb 95 p 8

[Article: "Russian Researchers Look for Cooperation with West"; "Arsamas Possesses Laser Technology, Infrared Cameras, Leuco-Sapphire"]

[FBIS Translated Text] Frankfurt—In March, at the Russian nuclear research center Arsamas 16, German and Russian scientists are hoping to meet to feel out the possibilities of cooperation. The Russian institute is primarily engaged in nuclear energy and nuclear fusion technology as well as laser and medical technology. Additional possible areas for joint activity include materials-handling technology for oil and gas plus materials and compounds technologies, reports the East-West agency, Society for Know-How and Technology Transfer mbH [Limited] (Kaiserstr. 46, 40479 Duesseldorf / Tel.: 0211-49 120 51).

Most recently in Arsamas a number of remarkable carbon-dioxide laser technology-based gadgets were developed, including a medical scalpel, a spectrometer and a laser analyzer. A gas analyzer has been conceived, above all, for tracking down of hydrocarbon compounds that is to detect pipeline leaks during helicopter monitoring flights.

The nuclear research center is currently busy on development of a deuterium-fluoride laser that allegedly operates flawlessly over a distance of 300 meters with a 1.5-kilowatt power consumption.

Another noteworthy area of activity involves artificial lenses made from leuco-sapphire that are produced by means of vacuum crystallization at Arsamas and processed using laser machine tools. Such lenses could be produced in strengths between three and 50 diopters. Their durability is reported to be over one century and their optical quality is greater than for plastic lenses. At present nearly 1,000 units of such lenses are being produced each month, mostly for the Moscow eye clinics (professor Fyodorov), and also for the Japanese market.

Most recently, for photography in infrared light and for filming in temperature fields, the institute has created a laser camera that allows photography even in the lambda zero to 10.6 mcm bandwidth. In this context, the infrared photography can also be transferred to normal photo paper. Using this system with high-speed photography, optical monitoring of the machining status of work pieces under laser machining is feasible. But such cameras could also, for example, be used to monitor the heat loss from buildings.

The nuclear research center currently employs nearly 5,000 employees including nearly 500 scientists with Ph.Ds. It is situated in the Nizhny Novgorod region about 450 kilometers from Moscow and about 160 kilometers from Nizhny Novgorod and in Moscow has its own branch office.

Pan-European JESSI Interim Report Presented

*MI2302101195 Bonn TECHNOLOGIE-NACHRICHTEN
MANAGEMENT-INFORMATIONEN in German
29 Dec 94 pp 11-12*

[FBIS Translated Text] At its semiannual meeting with representatives of the JESSI [Joint European Submicron Silicon Initiative] -funding governments and the EU Commission, the JESSI board reported on 28 October 1994 in Rome on the continued progress in all areas of the program, and pointed out the numerous achievements that lie behind the European microelectronics industry which is now a world class force in technology. In view of the impressive results achieved, it was decided to fix the JESSI budget for 1995 at ECU470 million (about \$600 million). This corresponds to the 1994 budget. Of this sum, 49 percent will be used for the "Technology" subprogram, 27 percent for "Applications," 14 percent for "Equipment and Materials," and 10 percent for "Basic and Long Term Research."

About 3,100 scientists and engineers from 180 companies and research institutes in 13 European countries are currently working on 73 JESSI projects. Their goal is to promote Europe's independence in the latest semiconductor technologies and to strengthen its electronic systems industry.

The government representatives were unanimously of the opinion that JESSI can produce a series of impressive results that need not fear comparison with worldwide competition.

The JESSI "Applications" subprogram is promoting and supporting the development of integrated circuits and development tools for new applications. These include, for example, high definition television and DAB (digital audio broadcasting, digital radio); the economic success of both programs depends to a crucial extent on the chips required for the purpose being available on time.

It may be regarded as an immediate success of JESSI that Europe leads the world in DAB—beating even America and Japan. Its strong position in the telecommunications sector is based on the availability of ultramodern chips that were developed by JESSI partners.

In addition, numerous JESSI CAD [computer-aided design] tools are now increasing productivity in chip design. Moreover, small- and medium-sized companies are being supported by a project that is already running in 10 European countries and offers not only services for design, the production of prototypes, and testing chips but also training programs and feasibility studies.

The JESSI "Technology" subprogram can now show results that are of outstanding importance for the entire European electronics industry. In the field of memories, competitive European products have become firmly established. For logistical applications, European industry now has an excellent 0.5 micrometer CMOS [complementary metal oxide semiconductor] process which was developed by the JESSI partners Alcatel, Mietec, CNET, ES2, GEC-Plessey, IMEC, Matra-MHS, NMRC, Philips, SGS-Thomson, and Siemens.

When JESSI was planned, there was a serious weakness in the European semiconductor industry in that it was greatly

dependent on imports for equipping its production sites. The JESSI "Equipment and Materials" subprogram has reduced this dependency. The technical and economic success is evident.

European producers are now offering, inter alia, wafer steppers, plasma etching modules, large diameter silicon wafers, and automatic testing facilities.

In the JESSI "Basic and Long Term Research" subprogram, various project groups are working jointly on tasks for the future. The key project is ADEQUAT. The basic know-how for the 0.35 micrometer and for 0.25 micrometer front end technology is already available here.

The majority of the projects are going according to plan. According to the present situation, 90 percent of the projects will be completed on time. The remaining 10 percent will be completed within three months of the originally planned date. A considerable achievement for such a complex program as JESSI!

When the JESSI program is completed, Europe will not only be able to produce world-class submicron silicon products, but it will also have a proven infrastructure in this field, allowing effective cooperation among developers all over the continent.

France: Fuzzy Logic Sensors Developed for Detection Systems

*BR2202104095 Paris ELECTRONIQUE
INTERNATIONAL in French 9 Feb 95 p 43*

[Report signed "Y.A.": "Development of 'Fuzzy' Sensors"]

[FBIS Translated Text] The concept of the "fuzzy" sensor is taking shape. The first neuro-fuzzy fire alarm sensor which was presented last year by Cerberus Guinard should mark the birth of a new line of sensors (Cerberus Guinard couples a neural network with fuzzy logic in its Algorex sensors). Alarmcom, which is also part of the Swiss Cerberus group, has just developed a range of "passive" IR burglar alarms using the Visatec technology—Very Intelligent Signal Analysis Technology—which among other things uses the rules of fuzzy logic. The heat signature left by an intruder is no longer identified by conventional signal processing using its frequency and amplitude but is instead established through a multicriteria analysis which uses the shape of the signal, its amplitude, pulse train, energy, and frequency spectrum independently of any predefined threshold values. These criteria thus shape the signal so that it can be compared with signal templates held in memory. When the correlation coefficient between the signal and its reference template has been calculated, a decision is made about whether or not to activate the alarm. Serge Ramaioli of Alarmcom explains: "Fuzzy logic provides very good detection capacity without any loss of immunity." However, this fine signal analysis resolution also requires a lens providing the best possible signal/noise ratio. Alarmcom uses a zoom mirror (similar to a parabolic reflector) whose facets have been organized in the optimal configuration to detect the heat signature of the human body. Another advantage offered by fuzzy logic is that it is quicker to develop and also takes up less room in memory and requires less calculating power (running on an 8-bit microcontroller) than a conventional program.

France: Tactical Missile Program Reviewed*95WS0194A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 6 Jan 95 p 73*

[Article by Jean Dupont: "Defense Committee Considers Future of Missile Industry"; introductory paragraph in boldface as published]

[FBIS Translated Text] **Reviewing current and future French missile programs, rapporteur Darrason is advocating both an adjustment to the inventory of munitions and preservation of the industrial plant through alliances in Europe.**

As a preamble to submitting his report on tactical missiles to Parliament at the end of January, Deputy Olivier Darrason (UDF [French Democratic Union]) has just been heard by the Defense Committee. This is the first time that the committee has taken such a close interest in the sector of tactical missiles, which are traditionally treated as poor relations during budget debates. But times change. The threat of an intense and very brief conflict (requiring only a very limited number of munitions) with the Soviet bloc has disappeared as a result of the collapse of the USSR. At the same time, there has arisen a new notion of an external conflict low in intensity but likely to last a long time. According to Darrason's preliminary report, that new strategic deal must lead "to an overall examination by the Armed Forces of what constitutes an optimal level of inventory, an examination which clearly has only begun at the present."

Darrason announced: "One of the first conclusions that I hope to draw in my report will have to do with the inadequacy of inventories in terms of the scenarios set forth in the White Paper, an inadequacy that will inevitably lead us to increase our orders in coming years. I also strongly hope that the Defense Committee will express its opposition to the practice of systematically reducing the number of missiles" (Editor's note: during arbitrations giving preference to delivery platforms).

It is therefore understandable why Darrason chose to wait until the minister of defense had announced the start of the long-range precision weapon (APITGD) program (see AIR & COSMOS/AVIATION INTERNATIONAL, No. 1499) before presenting Parliament with his report on French tactical missiles. He probably did not want his remarks on a necessary adjustment to munitions inventories to interfere with the decision by the minister, who simultaneously kicked off three new missile programs (the APTGD, the anti-infrastructure Apache, and the future antiship missile).

Incidentally, the minister's decision receives ample comment in Darrason's report. As regards the Apache family of air-to-surface missiles from which the APTGD will be derived, he indicates that the Air Force has plans to acquire 200 units in antirunway and "area deterioration" (minedropping) versions at a total cost of around 4.7 billion francs [Fr]. It is probable that 300 units of the anti-infrastructure Apache will be ordered, possibly in cooperation with Great Britain if the latter accepts Matra's

bid on the CASOM [Conventionally Armed Stand-Off Missile] (see AIR & COSMOS/AVIATION INTERNATIONAL, No. 1499).

Lastly, the deputy recalls that as regards the APTGD, the Defense Commission had unanimously preferred the Apache after listening to the two competing manufacturers (Louis Gallet on behalf of Aerospatiale [National Industrial Aerospace Company] and Noel Forgeard for Matra) just before the minister's decision was made. Only about 100 units of the Apache will be acquired. Darrason points out: "This clearly indicates that it is not a saturation weapon."

The rapporteur also expresses satisfaction with the decision to allow Aerospatiale to begin the future antiship missile (ANF) program. The reason is that it was urgent to reassure the German partner following unilateral cancellation of the equivalent ANS [supersonic antiship missile] program in 1991. This with a view to preparing the ground for the closer cooperation that Aerospatiale and Daimler-Benz Aerospace (formerly DASA [German Aerospace]) are attempting in the field of missiles.

Darrason adds that the start of the ANF program will enable Aerospatiale to return to a level of activity compatible with the preservation of its know-how (unique in the West) in the field of ramjets. "In 1994," he explains, "the team that Aerospatiale has working on ramjets has fallen to 125 individuals, whereas 205 seems to be the tolerable threshold." For its part, financing is already included in the planning law, since the rapporteur finds one line item there called "air-breathing transition" at an amount of Fr700 million and another for the same amount under the description "improvement of ASMP [medium-range air-to-surface missile]." "If we add to that the Fr170 million provided for the new-generation antiship missile, we see that 50 percent of this program is already being financed," Darrason concludes. The remaining amount may be contributed by Germany if it rejoins the program.

Moving on then to review all French missile programs, the deputy raises, but does not answer, the question of the antitank missiles whose "characteristics, and the number we have in inventory today, were determined on the basis of a conflict in Central Europe." The same question applies to the missiles now under development (the AC3G [third-generation antitank missile]). Lastly, he makes the first official mention of the rapprochement underway between Germany and the United States regarding the definition of a common antiballistic defense system (see AIR & COSMOS/AVIATION INTERNATIONAL, No. 1489).

Darrason concludes his remarks by discussing the future of the domestic missile industry and its two chief representatives: Aerospatiale and Matra. The situation of the former is described as "disastrous," with only Fr250 million worth of new orders in 1994 for a turnover of Fr5 billion. The latter, on the other hand, is currently doing reasonably well thanks to the success of the Mistral in the export market and the Mica [combat and self-defense missile], which will be mounted on the Mirage 2000-5's sold to Taiwan and Qatar. By the end of the century,

however, the situation may reverse itself, since Aerospa-tiale will be reaping the benefits of the programs it now has under development (Aster and ANF) just when production of the Mistral and Mica is starting to wind down. Darrason also feels that "Matra seems to be too specifically French: it has practically no programs underway in cooperation with others, a fact that makes its rapprochement with British Aerospace all the more important even though the latter company still needs to make a restructuring effort."

FRG Ministers Kanther, Wissmann Call for Improved Innovation Climate

95WS0206A Duesseldorf VDI NACHRICHTEN
in German 3 Feb 95 p 2

[Article by Veronika Hass: "Minister Kanther: More Money for High-Tech"; subhead: "VCI President Gert Becker Bemoans 'Negative Attitudes' to Science and Technology"]

[FBIS Translated Text] Frankfurt, 3 Feb (VDI-N)—Licensing procedures for new technologies in Germany are in urgent need of revision if the country is to maintain its position among the leading industrial nations for the future. This was the call issued by Federal Interior Minister Manfred Kanther. At a function of the Konrad Adenauer Foundation last week in Frankfurt, Kanther said that the trend should not reach the laissez-faire stage, but there was no reason to have the most long-drawn-out and tedious process imaginable.

He said that high technology markets are the ones with the highest growth potential. He went on to say that for Germany not to lose its foothold in that market the debate about new research and development could not be left entirely to "professional doubters and ditherers." Germany has become more ponderous and has to regain its dynamism. The Federal government sees clearly, he says, that the field of high technology research and development will have to be given more consideration in the Federal budget. But there is also a need for banks, which ought to evince "just a little bit" of willingness to take risks.

Kanther further pointed out that there is a significant need for actions which cross party lines. He said, "That is why a 'Council for Research, Technology and Innovation' should be established by the Federal Chancellor to bring together independent people from science and business." It is a matter of combining forces and deploying research funding more efficiently in order to reveal the potential of new technologies. He said that opportunities and risks would have to be balanced carefully. But anyone who wanted to eliminate all risks would also give up all opportunities, as he said at the function of the foundation, which has close ties with the CDU [Christian Democratic Union].

The president of the Chemical Industry Association (VCI), and chairman of the board of Degussa AG, Gert Becker, pointed out that the years of dissension about the use of gene technology clearly revealed where a climate which was not friendly enough towards research and technology would lead. In this connection, he pointed to the investments of the German chemical industry in the U.S. alone, which by now amount to hundreds of millions of dollars and have created far more than 1,000 jobs. In view of the favorable

conditions which Germany offers as a location, among which he includes the high level of education and the rich research landscape, he called it "regrettable" that business and science have not succeeded in taking advantage of these strengths. He said that one of the causes was the "thicket of laws, ordinances, regulations and bureaucratic procedures." These were Becker's words: "The order of the day is the evaluation of the consequences of legislation."

He said that it is serious cause for alarm that not a single foreign company has even announced the founding of a research facility in Germany in the fields of biotechnology or of gene technology. In the field of gene technology, Becker said that there are 300 plants in the U.S. by this time, 120 in Japan, but only six in Germany. A change in regulative conditions and in the generally negative basic attitude towards science in Germany is thus urgently necessary.

Minister of Transport Matthias Wissmann demanded a more open relationship between business, science and government. One thing intended to further progress in this direction is a "strategic circle" organized within the Ministry of Research which Wissmann believes is an alternative to the scientific advisory boards which exist nationally and in the Laender but are no longer effective.

In this connection, the Hessian CDU politician Traudl Herrhausen called for a more convincing involvement of scientists in the practical realization of their research results. She said that opponents of a new technology are usually much more visible than its supporters, who need to argue with more passion and bring in their own emotions.

Industrial Leader Views Germany's High-Tech Competitiveness

95WS0208B Duesseldorf HANDELSBLATT in German
6 Feb 95 p 5

[Article by Rainer Nahrendorf: "German Industry Must Catch Up in High-Tech Competitiveness;" first paragraph is HANDELSBLATT introduction]

[FBIS Translated Text] In order to strengthen the dynamic of innovation in Germany and to utilize the opportunities of the information society, the telephone and network monopoly should be abolished even before the last possible deadline in 1998, in the opinion of BDI [Federal Association of German Industry] president Olaf Henkel.

Duesseldorf—Deregulation should also be an important subject for the planned technology council. The latter should perceive itself as a motor for reforms, said Henkel in a conversation with HANDELSBLATT. Henkel warned that in the euphoria of the upswing it should not be forgotten that the German export successes were largely achieved with mature products or products being phased-out and only to a minor part with high-technology products or products in markets that will grow rapidly in the future. Only about 14 percent of German exports applied to top technology products.

Henkel said, "We are living in the past." In his opinion, it is not enough for Germany to occupy a good competitive

position in the field of high-ranking technology. Germany must also be in the forefront of the top technology.

Globalization: A Correct Strategy

Microelectronics is a cross-section technology. A high-wage country such as Germany can only pay high wages if it produces and exports products with high added value. The FRG cannot afford to buy expensive components abroad, add minor value to them in Germany and then reexport them.

For Mercedes-Benz the transition from Made in Germany to Made by Mercedes-Benz could be quite a successful concept, however. For BMW or other large companies as well, globalization is the only correct strategy. But while it also a matter of jobs for people in one's own country and the middle-sized industry hardly has opportunities for globalization, it does not just involve the competitiveness of Germany as a location for industry and German society as a whole.

Although the situation within the industries varies a great deal and there should be caution regarding sweeping judgments about competitiveness in individual branches, this much can be said: The German mechanical engineering industry has again raised its competitiveness—particularly through an improvement in the cost structure.

This applies to the German automobile industry as well, although in comparison with its recovered competitors—for example in the United States—it still has additional reserves available to increase its productivity. Says Henkel: "The products of the German automobile industry are fantastic. But its production costs have not yet reached the international standard."

The chemical industry has also moved up front again, although in Germany it lags behind in its high-tech field—such as in genetic engineering—or manages its proximity to the best in the world only because it does research and manufacturing abroad. Large amounts of effort are needed in aerospace.

Henkel described the competitive situation in German industry in information technology as unsatisfactory to a large degree. The trade balance deficit in information technology is more than 13 billion German marks [DM] in 1993. In this typical high-tech sector Germany is effectively wiped out. In communications technology as well the trade balance with Japan and the United States is negative.

The textile industry has almost been chased out of the country by the high wage costs and the rigid working hour regulations. The German nuclear technology industry is certainly good, but it is increasingly feeling the disadvantage of no longer being able to build any new nuclear technology facilities in its own country.

On the Road to the Information Society

To be sure, Germany's spending for research and development has not decreased in past years but has definitely grown, but beginning with the mid-1970s the general industrial environment prevented investments in new products and new markets. High wage costs, lack of flexibility, overregimentation, short and rigid working

hours, high taxes and fees burdened not only production but in equal measure the resources for research and development, he said.

It would therefore be very difficult to make up for the lost 15 or even 20 years. The country missed catching up with the information technology as early as the mid-1970s.

Paradoxically, accusations that German industry is doing too little for research and development and has an innovation deficit often come precisely from those politicians who in the past frequently prevented technical progress for ideological reasons or who are still putting the brake on it today.

Over the next 10 to 20 years German society will change into an information society. In the United States of America the information society is already to some extent reality. There, thousands of small and medium-sized as well as large companies, such as Microsoft, have sprung up and are successful through the connection of information and telecommunications technology.

The information society creates interesting jobs, which could also bring our country further ahead. The president of BDI says: "Furthermore, it is also fun to travel down the information superhighway."

Henkel regards it as an important task for the minister for education, research, science and technology to open up the way to the information society. Part of this is not only a corresponding contribution of budget funds from the ministry, but also a clear word to Postal Minister Boetsch. The CSU [Christian Social Union] minister should say goodbye to the idea of being able to wait to liberalize the field of telecommunications until 1998. Henkel demands. No one prevents Boetsch from undertaking liberalization steps before the last possible date established by the commission.

The president of BDI advocated changing the makeup of the planned Technology Council with the subject. Should, for example, the Technology Council concern itself with the information society, different persons should be on it than when dealing with energy technology.

Middle-Sized Industry Should Have a Seat on the Technology Council

In Henkel's opinion, the Technology Council should in particular take up deregulation. In many fields where the German economy is behind the reason is insufficient deregulation. Henkel wishes for a Technology Council that regards itself as a motor for reforms. On the other hand, it would be wrong if this body perceived itself as a "mini-MITI" [Ministry of International Trade and Industry, Japan] or conducted industrial policy in the classic sense. Henkel also considers it very important that this body of experts include people from medium-sized industry as well.

Henkel expressed his concern that in Germany industrial jobs are lost significantly faster than in other localities and, at the same time, in the area of the most sophisticated services new jobs are created less rapidly than in other countries.

Henkel put forward two reasons for this phenomenon. First, along with industry the most critical services are also vanishing from Germany; second, where there has been aggressive deregulation medium-sized industrial and long-term new jobs have been created.

This development is shown in work that uses telecommunications, for example. In the United States two million people now work at home by computer. In England there are already several hundreds of thousands, in France there are thousands of jobs that use telecommunication, but in Germany only a few hundred.

Too Few Jobs Using Telecommunications

To Henkel the high cost of telecommunications in Germany is an obstacle to employment. Greater utilization of fiberoptic networks, copper wires and satellite connections would not cost anyone more money, but would create work and new ways to make a living and bring the German economy financial advantages. Says Henkel: "If we drag our feet in abolishing the telephone and network monopoly and in deregulating, we pass up the opportunity to create jobs."

It is depressing that in fighting unemployment—for example in combatting long-term unemployment—the Germans always attack the symptoms instead of going to the bottom of the causes and paving the way for the creation of modern, promising jobs.

One should not always keep talking about reforms; they should finally be tackled. Henkel has confidence in the commitment of the Federal Government to abolish the capital gains tax by 1 January 1996 and to lower the business earnings tax to the benefit of medium-sized industry. Add to this that German industry must catch up particularly in high-tech competitiveness.

German Research Ministry To Fund Creation of High-Tech Companies

BR2302084495 Paris *ELECTRONIQUE INTERNATIONAL* HEBDO in French 16 Feb 95 p 7

[Unattributed report: "Germany To Subsidize Creation of High-Tech Companies"]

[FBIS Translated Text] The German Research and Technology Ministry wants to contribute to creating high-tech companies and is looking for the funds which are necessary to finance a program called "Participation in the Capital of Newly-Created Technological Companies." The program will cover the years 1995 to 2000. Discussions with the EU Commission and various banks have started. Over the last five years, a similar program has led to a participation in the creation of 354 companies for a total amount of 255 million Deutsche marks.

Germany: New Program to Aid Small Technology Firms Announced

95WS0170A Duesseldorf *HANDELSBLATT* in German 24 Jan 95 p 1

[Article by fdo: "Ruettgers: New Program for Small Technology Firms," under the rubric: "The Ministry of Future Affairs: Funds for Start-Up Entrepreneurs"]

[FBIS Translated Text] The Minister for Future Affairs, Juergen Ruettgers, has announced a new program of "participation capital for small technology companies" for 1995-2000. He is confident that this program can start shortly, said the Minister in Bonn.

Discussions are taking place now with the European Union (EU). After these talks are concluded, he will announce particulars regarding the type and scope of the support program. Besides the EU Commission, the German Bank of Equalization and the Reconstruction Bank will participate.

Within the framework of a model trial, the Research Ministry has given 354 pledges for participation to young technology firms totalling 255 million German marks [DM] by the end of 1994. The experiences are positive. Only 42 participants (11.9 percent) have failed. In the new Lands, 235 companies have been founded with a similar model. With both projects together, about 3,600 new jobs could be created.

In this conjunction, Ruettgers greeted the private initiative known as "German Founder's Fund." In addition to the chemical company Rhone-Poulenc and the magazine "impulse," the Senior Expert Service and the Federal Association of Young Entrepreneurs are committed to this. It has the goal of helping unemployed young academicians from the natural sciences and engineering in establishing companies for their livelihood. As starting capital, the chemical concern made DM 500,000 available.

Ruettgers called on the companies to support the Federal Government in its innovation policy and to invest "more in research and development." As an export nation and high-wage country, Germany must maintain its position in those markets where high net value added can be achieved with innovative products and services. In the budget for 1995, the record amount of DM 2 billion is proposed for the important "key technologies of tomorrow." Just the funds for environmental technologies will increase by 16 percent. For information technology, almost 6 percent more will be available.

Germany: Editorial Assesses Policies, Prospects for Ruettgers, Ministry

95WS0208A Frankfurt/Main *FRANKFURTER ALLGEMEINE* in German 6 Feb 95 p 11

[Article by Heinz Stuewe: "Minister for the Future"]

[FBIS Translated Text] Juergen Ruettgers defended himself only half-heartedly against the title of minister of the future. This concept creates expectations, in the economy as well. The bar is set high. If Ruettgers jumps under it, the disappointment will be all the greater. His access to the chancellor and the backup he receives from the Union [Christian Democratic Union and Christian Social Union] group in parliament are good prerequisites. This week he will explain the basic principles of his policy.

But first the coalition must fend off the accusation that Ruettgers is starting by breaking his promise. The Union and the FDP [Free Democratic Party] have themselves needlessly brought on this discussion with the promise in the coalition agreement to increase the research budget disproportionately. The need to save does not permit an

increase for 1995 greater than the one planned before the election (namely by 250 million German marks [DM] to 9.5 billion). With a total budget for the combined Education and Research Ministry of DM 15.5 billion, one must resort to the pocket calculator in order to find any growth at all. The disproportionately good treatment of this budget will probably end up so that it remains spared any cuts.

Ruettgers knows that there will be a limit in the 1996 budget as well. The minister does not want to withdraw earlier admissions by delegate Ruettgers regarding the necessity of budget consolidation and of lowering the government share. This is to his credit. Only enterprises which made a profit can invest in new ideas and products, Ruettgers reproached the opposition. Anyone who advocates this knowledge may not then himself contribute to the narrowing of the discussion to the level of the government research spending.

The national budget for science and research in Germany amounts to about DM 80 billion. The economy pays 50 billion of that. It is food for thought that the German research spending, in the end amounting to 2.6 percent of the gross social product, has fallen behind that of Japan and the U.S. But premature allocations of guilt in the direction of the government are ruled out. Germany is well ahead worldwide in public spending, at least for civilian research and development. However, efforts by companies have slackened in recent times. The minister has an urgent task in getting this innovation motor back on track.

The question thus arises of whether indirect promotion of innovation that is not tied to certain fields of technology and projects must be reinforced. Supplements to research investments and personnel costs for development are only being granted in the new laender at this time. At the same time this support, practiced years ago in the old FRG as well, is more harmless from the aspect of regulative policy than project support, which always harbors the danger of government apron-strings for the companies. For that reason the question of whether a particular tax break for business research spending should be introduced can only be decided in combination with business tax reform.

A widespread complaint says that a large scientific potential in Germany in fields such as information technology or biosciences is not or too slowly being converted into marketable products. Previously, with lower research spending, there was better cooperation between government-financed research institutions and industry, says Siemens research board member Hans Guenter Danielmayer regretfully. Even Ruettgers's predecessors therefore established numerous discussion groups under the motto of "strategy dialogue" between science, government and the economy in order to bundle the resources. The chancellor's high-ranking Council for Research and Technology is now to be called in, a year after the cabinet decision. Ruettgers does not envision the well-being of research policy in an extensive counselling system, however. He wants to retain the committees at the professional level and other than that make political decisions.

The fashion word "strategic technology policy" does not protect against erroneous investments of public funds. The

best method to discover innovation remains the market. In the ideal case the role of the state lies in financing basic research and in supporting work on new lines of technology that overburden individual companies, in order to withdraw as market introduction approaches. In electrical engineering and microelectronics, for example, the product cycles follow one another increasingly rapidly, however. That no longer fits the concept of first doing research and then looking for an application.

For this reason it may be warranted to concentrate project support for key technologies more heavily to leading topics jointly agreed on by the economy and science and to tackle them in joint projects. But this must involve real technological leaps. The companies may not dump responsibility for product development onto the state. One should proceed primarily according to the following principle: "He who helps make decisions, must help pay."

In addition to more effective contribution of funding, Ruettgers wants to give added importance to research policy without money. Thus, one project group is to deal with reducing the obstacles to innovations. It involves going through laws, ordinances and implementation regulations, investigating the complaints of the economy and science. This little job is not worth headlines but is all the more necessary.

There will only be success if one does not stop at where the ministry's responsibility ends. As an advocate of innovation Ruettgers must get involved when it is a matter of animal experiments, subsidies for dying industries or the legal framework for multimedia services. In so doing he will have to risk a conflict or two even with cabinet colleagues, if he wants to be a minister for and with the future.

FRG Research Minister Ruettgers Comments on Policy

95WS0214B Duesseldorf *HANDELSBLATT* in German
9 Feb 95 p 4

[Article: "Ruettgers Formulates Thrusts of Future Research Policy"; Subhead: "Ministry for Future's New Energy Program"]

[FBIS Translated Text] Bonn, 8 February 1995—Juergen Ruettgers, minister for the future, wants to concentrate his ministry's support programs on stand-out projects to overcome innovation weaknesses in cooperation with the private sector. Such was his assertion at his first press appearance in Bonn transmitted via video conferencing to Berlin.

Models for the activity would include the transition to the information society, the biotechnological revolution of the twenty-first century, economic growth in the materials cycle, energy production with minimum CO₂-emission and the innovation system as a network. This year Ruettgers intends to shell out 970 million German marks [DM] for information technology. Ruettgers emphasized that in the future his ministry intends to devote itself intensively to the task of creating favorable framework conditions for

innovation. For information technology, this means that deregulation of the telecommunications market has to be concluded by 1997.

In biotechnology, Ruettgers wants to push for a change in the "EU guidelines for genetic engineering legislation that dampen innovation." Additionally, biotechnological projects entailing nearly DM300 million are to be supported so as "not to sleep through the biotechnological revolution of the twenty-first century." Health research is to have DM550 million plowed into it. Ruettgers announced a fresh support program for energy research. The objective is to be continued scaling down of CO₂ emissions. In the future activities in support of the environment are to focus more on product-integrated concepts. Ruettgers also advocated continuance of funding for basic research. In the contentious issue between the federal government and the laender of financing for university construction, the minister wants to seek out dialogue. The aim would be effective financing for university construction on the basis of recommendations in the Eckwerte paper of 1993 and the revised rates of regular course periods.

In the area of occupational education, Ruettgers announced for 1996, in addition to the master's grant, establishing an "activity supporting occupational education for the talented" and expanding the possibility of access to the university.

In an initial reaction, Social Democratic Party (SPD) education and research policy spokesman, Peter Glotz, reproached Ruettgers' "timid action and overly slick educational diplomacy." Hans-Olaf Henkel, president of the Federal Association of German Industry, had previously faulted increases in the 1995 research budget for turning out to be "extremely modest." He called for mid-size industry to get increased incentives for research outlays from lower taxes.

Study on Industrial Research in Eastern Germany Published

95WS0214A Duesseldorf HANDELSBLATT in German
9 Feb 95 p 4

[Article: "Research Situation Remains Precarious"; Sub-head: "New Laender / DIW Deems Support Adequate"]

[FBIS Translated Text] Berlin, 8 February 1995—In the opinion of the German Economic Research Institute (DIW) the plight of industrial research in East Germany should be viewed as quite precarious. The commitment by large firms in the research and development (R&D) sector remains minimal. The innovation activities of small and mid-size enterprises are, in large part, only possible because they have been significantly supported.

But it is erroneous to demand expanded support since the growth of transfer institutes and non-industrial research institutes has made excellent headway. Instead, the support system as such has to be rethought in order to create transparent and calculable investment conditions. That is why the DIW is encouraging a long-term basic support for firms especially in the processing sector, including services bordering on production. A support program running for

more than a decade might be useful wherein firms, on the entitlement principle, should obtain a wage-cost subsidy for R&D personnel and an increased investment supplement for the research sector.

In 1992, the new laender received a total volume of 1.3 billion German marks [DM], 2.5 percent of R&D outlays in the processing sector. Production's percentage was five percent. Personnel enjoyed a more favorable ratio with a six-percent share attributable to lower salaries. The number of researchers engaged in industry dropped from 85,700 (1989) to nearly 16,000 at present. R&D activities in East Germany are concentrated in the smaller companies. In 1992 one fourth of the funding spent on R&D went to firms having fewer than 100 employees.

In 1993 the share of federal support for companies' internal R&D outlays totaled approximately 40 percent (original laender, five percent, in the context of civilian research). In 1994, the volume of support is projected at more than DM770 million. The focus of attention has been programs in industries having fewer than 250 employees.

The bulk of non-university research institutes matches that in the original laender. Nearly 90 percent of the 12,600 employees came from East Germany. The 61 GmbH [limited] companies for research that had been created by establishing departments of companies under the trust institute, and 160 other firms originating mostly as academic and university establishments, continue to depend on public funding to a considerable degree.

Italy: Science Park To Be Set Up in Padua

BR2102135695 Milan IL SOLE-24 ORE in Italian
1 Feb 95 p 12

[Article by Flavio Orati: "The Plan for a Technological Park Gets Underway in Padua—Go-Ahead for the Telematic Laboratory Linked to Internet"]

[FBIS Translated Text] They are accelerating the projects for Padua's scientific park and BIC [Business Innovation Center] as part of the European Union's SPRINT [Strategic Program for Innovation and Technology Transfer] program.

The Internet terminal was inaugurated a few days ago. The initiative came from the Chamber of Commerce of this major town in the Venice area, and its realization is thanks to the synergies that were activated some years ago between the special company, Tecnopadova (linked with the same Chamber of Commerce), and the Padua research consortium.

The telematic laboratory has been set up in the innovation center, around which the scientific park revolves. The special hardware makes it possible to connect up to the Internet telematic superhighway that already has over 30 million users worldwide.

This link-up has also been made possible thanks to the operative support of Padua University's computer center, that works around the clock.

In this way Padua is relaunching its role as the leading city in the Venice region in the advanced services sector, so confirming a vocation that has been consolidated over the years.

"We have tried to interpret the real requirements of businesses that make the best use of the technological resources present in the market—affirms Antonio Frigo, president of the Chamber of Commerce, of Tecnopadova, and of the Interporto joint stock company—by offering local industry a preview of the possibility of obtaining new business opportunities."

As Giorgio Medici, responsible for the Internet link-up, has assured, the commercial circuit, that is dedicated to companies, will also become operative in the next few days. They do not just want a simple connection through which they can consult the numerous databases that are available, but intend to use the network for various commercial operations, with all parts of the world, in real time, from their own computer workstations.

So the plan, that was developed by the university together with the Chamber of Commerce, the local industrial association, the municipality, and the district, for the Padua scientific park, is being increasingly put into effect.

The first stage has been characterized by the creation of a center providing services to business, an information counter, and an incubator for high technology companies that can already count seven industrial initiatives among their assets.

The Magnete, a building covering 7,500 square meters, that will house both the university laboratories and the productive units of advanced technology companies, will be constructed during the second phase, between 1995 and 2000.

The coordinated realization of a system of productive installations in the areas located in the south east of the province of Padua, in the Venice direction, is planned for the third stage.

France: Regional Information Highways Experiments Unveiled

BR2202133395 Paris *ELECTRONIQUE INTERNATIONAL* 9 Feb 95 p 14

[Report by Frederic Fassot: "France Telecom: Two Hundred to Three Hundred Million Francs for Information Highway Experiments"]

[FBIS Translated Excerpt] Among the 30 "major" experimental projects on information highways submitted to the government, Lyonnaise Communications and CGV [General Video-Communication Company] are also proposing "platforms" worth between 30 and 100 million francs [Fr].

Five hundred and twenty-five proposals corresponding to 618 experimental projects for platforms and services were submitted to the government following a call for proposals on information highways which closed last 23 January. Although the majority of proposals concerns services, one third of the projects involves infrastructure and includes technological developments. "There are about 30 "major projects" among these proposals," said Didier Lombard, director general of industrial strategy, during a debate organised by IREST [Science and Technology Research and Study Institute] on this theme. Without revealing the identity of the participants, Didier Lombard nonetheless specified that many large regional projects had been submitted. To mention one, the Alsace Region's Cristal project which proposes installing multimedia terminals with visual telephone capacity in each district with a view to offering the same public services as in large cities (ANPE [National Employment Agencies], social security, etc). This project will require an investment in infrastructure worth Fr1.8 billion over four years and will involve industrial partners, including Alcatel Business Systems, France Telecom, and IBM. However, the project's funding has not been finalized.

France Telecom, Lyonnaise Communications and the CVG also unveiled their plans. They are slightly different from those announced in our 19 January edition. France Telecom has submitted about 50 proposals, not all similar in scope and generally undefined in geographical terms. Without going into details of these proposals, the public operator will also test ADSL [Asymmetric Bit Rate Digital Subscriber Line] technology for the transmission of one or two television programs on its telephone network (neither the size nor the location of the experiment is known). In all, the operator should commit Fr200 to 300 million to these experiments, according to Jean-Francois Latour, deputy director at France Telecom's image service. However, France Telecom's plans for high speed networks overshoot the government's time schedule. But we are still far from the 100,000 to 500,000 subscribers connected to fiber optic networks announced by the daily newspapers. According to J.F. Latour, the DORA [optical distribution in the access network], which is currently at industrial negotiation phase, should lead to the connection of several sites accommodating 10,000 subscribers from the beginning of 1996. It will only be during the subsequent phase (1998-1999) that a decision may be taken on connecting several hundred thousand subscribers.

The DECT Mobile Telephone Tested in Annecy and Nice

As the leading French cable operator from the beginning of this year, with a third of the market share due to the unplanned purchase of COM-DEV cable networks, Lyonnaise Communications is going to equip its Parisian network with a cable return channel with a view to offering, from June onwards, different services on PC [personal computer] (PC cable offer) in addition to TV programs (cable TV). In association with France Telecom, SAT, Cap Gemini Sogerti, INRIA [National Institute for Research on Data Processing and Automation], and Sligos, for the technical part, and with 25 publishers of services, the cable operator intends committing Fr100 million to this project (infrastructure, modem cards, servers, routing, marketing budget, etc). In addition to these services in Annecy, it will also offer the subscriber a mobile telephone service using the DECT [Digital European Cordless Telecommunications] standard. The initial phase of the project should cost Fr30 million. "Offering telephone services on the cable calls for additional investment but costs 50 percent less than if we were starting from zero," said Cyrille Du Peloux, president of Lyonnaise Communications.

CGV, for its part, will be proposing multimedia services on television and PC (notably with Canal Plus [private television channel] for games and small ads) to 5,000 to 10,000 homes in Nice as well as telephone services. But for the time being, the second French cable operator has not decided between a classic wire service and a DECT mobile service. To offer these services, the CGV is to build a high speed fiber optic network using its existing network. "It will cost us Fr3,200 per connection," said Jean-Philippe Santini, director general of CGV, who estimates the total cost of the "Riviera" project in Nice at Fr30 million.

Large German Companies Prepare for Opening Up of Telecom Sector

BR0103130495 Paris *ELECTRONIQUE INTERNATIONAL* HEBDO in French 16 Feb 95 p 13

[Elisabeth Feder report: "German Heavyweights Prepare for Opening up of Telecommunication Markets"]

[FBIS Translated Text] Market forecasts in the field of telecommunications, especially with the end of the Deutsche Telekom monopoly now on the horizon at the beginning of 1998 for telephone services and infrastructures, are whetting the appetites of the large German industrial groups. Strategic agreements with foreign partners who can bring their network know-how and/or an international presence are now consolidating their offensives with the creation of joint companies and the announcement of major investments: almost 4 billion Deutsche marks [DM] for Thyssen and Bell South; DM5 billion for Veba [Vereinigte Elektrizitaets- und Bergwerks-Aktiengesellschaft] and Cable & Wireless, and DM1.5 billion for Viag [Vereinigte Industrie-Unternehmungen AG—United Industrial Companies] and British Telecom (BT). A Viag spokesman said: "If we actually get a telephone service operating license, then the total investment will be many times that sum." Energy supplier RWE [Rheinisch-Westfaelische Elektrizitaetswerk AG] is still looking for a partner; it could be

Unisource, a consortium grouping the telecom operators of the Netherlands, Sweden, Spain, and Switzerland, and possibly AT&T (which already works with Unisource).

Two or Three Licenses for 1998

With DM70 billion now and DM100 billion by the year 2000, the German telecommunications market is the largest market in Europe. Deutsche Telekom currently holds a 96-percent market share. The licenses promised for 1998—for the time being people are talking of two or three licenses—are therefore highly coveted. Veba has so far been the most aggressive group in the telecom sector through its subsidiary Vebacom. Before its agreement with Cable & Wireless it had already decided to invest DM6 billion in the coming 10 years to develop its existing services. It has shares in German radiotelecommunication networks (DCS1800), in France (15 percent stake in the Bouygues-led consortium), and in the Iridium satellite radiotelecom project (10 percent). The company also has a license to operate a private radioelectric network and operates a cable TV network. The agreement it has signed

with Cable & Wireless is in line with its objective of becoming the number one competitor of Deutsche Telekom. Veba thus envisages setting up an all-service infrastructure covering the whole of Germany for an additional investment of DM5 billion. The company will not say, however, whether all the announced investments will remain in place if it does not obtain a license. Viag has similar ambitions. Viag Interkom, the joint subsidiary created with BT, will include all of BT's German activities. Initially it will propose communications services to major companies on Viag's existing internal network. RWE and Thyssen have also already submitted an application for a telephone operating license for 1998. The RWE group alone, currently running the largest private network in Germany, has announced it is to invest DM1.5 billion for corporate services on its network. In addition, the metal-working group Thyssen, which only has a network of 3,000 subscribers (internal to the group), has no intention of building its own network. It intends relying on existing infrastructures which it will rent to provide telecommunications services.

IFO Predicts Increased Investment Thrust in EU During 1995-96

95WS0205B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 17 Jan 95 p 2

[Unattributed article: "Ifo Predicts Investment Thrust in Europe"]

[FBIS Translated Text] Munich—According to the estimates of the Munich Ifo Institute, investments in European Union nations will grow sharply over the next five years. In 1995 and 1996, industry, above all, will increase its spending, Ifo scientists predict, referring to the results of a conference of European research institutes. Toward the end of the century the investments will then increasingly be borne by the service sector. According to the estimates of the research institutes organized in Euro-Invest, EU's economic growth of more than two percent in 1994 represents the beginning of an economic upswing based on the medium term. EU's expansion by the countries of Austria, Finland and Sweden will also contribute to this. Investments profit from this development. Thus, industry will increase its spending in 1995 by about 10 percent. The pent-up demand for new equipment during the recession will now loosen up due to the invigoration of business. The expansion of investments in 1995 will be most obvious in investment goods, for which Euro-Invest expects an increase of about 14 percent. Although the growth will slow by 1999, at an average of eight percent annually it will remain significantly higher than in other industrial sectors. Especially dynamic investment activity is thereby predicted for Great Britain.

In the area of consumer goods a strong increase is expected for 1995, Ifo further reports. However, this dynamic will quickly decline again, since in the classic consumer goods branches of textiles and clothing the strong competitive pressure from the low-wage countries will make itself felt. Investments are to grow particularly sharply in eastern Germany and Spain. The investments by the service sector are also supposed to increase disproportionately by not quite eight percent. Accordingly, the prognoses will develop in a particularly dynamic way as a result of the fields of telecommunication, transportation and logistics. In the coming years investments by the service sector are to grow sharply, while they will clearly increase more slowly in industry.

Small, Medium-Sized Companies Optimistic About Future Growth in EU

95WS0205A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 17 Jan 95 p 2

[Article by Michael Stabenow: "Medium-Sized Businesses Confident"]

[FBIS Translated Text] Small and medium-sized businesses and those who represent their interests see many reasons to complain about the European Union's and its member nations' policy for medium-sized enterprise. However, the everyday situation for small and medium-sized companies between Lapland and Andalusia does not look so gloomy if you take into account the now published results of a survey, jointly commissioned by the European Commission and the British Trade ministry, among approximately 40,000 enterprises in 17 European countries. The study involved the 15 EU member nations as well as Malta and Switzerland.

Of the 5,000 enterprises which replied to the joint survey by consulting companies Grant Thornton International and the British research bureau Business Strategies, Ltd. (BSL), 65 percent expect higher turnover in 1995. At the end of 1993 the corresponding figure was 47 percent, but a year before only 42 percent. Employment in medium-sized enterprises is likely to develop in a more favorable way than last year. Before the end of the year a clear majority anticipated a decline in employment figures. Now, as many as 27 percent expect more jobs, 12 percent fewer jobs and 58 the same number of employed in their companies.

The difference between optimists and pessimists is even greater when evaluating the export opportunities: 32 percent expect higher, but only three percent lower exports. Estimates of the development of profits in the companies is also encouraging: Nearly half of the replies received (46 percent) indicate growth. At the end of 1993 the corresponding share was only one-third. A year before, it was even a majority of the companies that expected lower profitability. Finally, 32 percent of those asked anticipated unchanged profitability for 1995; only 18 percent were ready to face a deterioration.

The prognoses are particularly favorable for Great Britain, Ireland and Sweden, reports Clive Bennett, in charge of European development issues in Grant Thornton International's representation to the EU. This welcome development can be traced to early economic recovery in these nations. The Italian and Greek companies also expressed their optimism.

Expectations by Small and Medium-Sized Companies for 1995 (in percent of answers)

European Union	Higher	unchanged	lower	not applicable
Turnover/production	65	26	7	2
Employment	27	58	12	3
Profitability	46	32	18	4
Exports	32	19	3	46
Retail prices	40	39	15	6
Capital investments	34	37	13	16
Training	32	44	4	20
R&D	21	33	3	43
Advertising	24	51	10	15

Source: Grant Thornton International/BSL European Business Survey

The companies surveyed expect a clear increase in capital investments and only 13 percent anticipate a decrease. Clive Bennett observed a more restrained mood with a view to the development of spending in Germany, France and Belgium. This is also expressed in the predictions for retail prices. In France and Luxembourg expectations by medium-sized companies indicate price reductions. On the other hand, not quite half of those surveyed in Italy, Great Britain, Ireland and Sweden are confident that there will be higher profits in 1995.

"These fluctuations could lead to certain interesting shifts in the relative competitive ability of the European countries," said Bennett. It is encouraging that everywhere in Europe it is possible to observe clear indications of an upswing, he said. The important thing now is that the governments support this dynamic with an appropriate policy that is favorable for medium-sized businesses.

France: Aviation, Defense Industries Win Offset Agreement

95WS0195A Paris AIR & COSMOS/AVIATION
INTERNATIONAL in French 2 Dec 94 p 13

[Article by Jean-Pierre Casamayou: "Hawkeye: Offset Agreement Signed"; introductory paragraph in boldface as published]

[FBIS Translated Text] If E-2C Hawkeye radar aircraft are purchased, Northrop Grumman will offset 100 percent of its share of the contract. French industry will receive contracts worth over 2 billion francs [Fr], with priority going to small and medium-size industries and firms.

After several months of difficult negotiations, Grumman International has signed an agreement on the industrial offsets to be granted in exchange for the purchase of two E-2C Hawkeye radar aircraft. That offset agreement totals 100 percent of the amount of the contract assigned to Northrop-Grumman, or about 70 percent of the first installment, currently estimated at Fr3 billion. Certain equipment—the Allison turboprops, for example—is being purchased directly without going through Grumman. That necessary condition having been met, the order for the aircraft using the FMS (Foreign Military Sales) procedure should follow very shortly.

The offset agreement was, along with the price of the aircraft, a decisive factor in the acquisition program. The reason is that ever since the E-3F AWACS radar aircraft were purchased from Boeing (see below), industrial offsets of this kind have been unavoidable in connection with any purchase of defense equipment abroad. According to the negotiators, "it will also enable French industry to obtain orders in the United States in the fields of aeronautics, defense, and high technology." In addition, it provides for direct investments in France on the order of 15 to 20 percent of the total amount of the contract. While the offsets give priority to the defense and aeronautical industries, other sectors are not being ruled out.

One of the points negotiated calls for U.S. industry to give priority to PMI/PME [small and medium-size industries and firms]. It was decided to provide a bonus for any contract signed with a PMI/PME. In such cases, a certain multiplying factor is to be applied to the amount of the contract signed. To ensure proper implementation of the offset program, it was also decided to prepare a report every six months. Also included is the possibility of incurring penalties if the terms of the agreement are not respected.

To negotiate and manage the offsets in question, GIFAS [French Aerospace Industries Group] and the other groups of the same kind have established an ad hoc company called SE21 (Company for International Industrial Exchanges). The stockholders are GIFAS and GETECA (a combined total of 50 percent); the SPER (Union of Professional Electronic Industries) (16 percent); GICAT (ground weapon industries) and GICAN (naval armament industry) with 12 percent each; and the Richelieu Committee, representing the PMI/PME, with the remaining 10 percent. But officials at SE21 insist that the amount of the offsets, which should exceed Fr2 billion, will not be divided pro rata among the stockholders. All the bids will be submitted to Northrop Grumman on an equal basis.

But SE21's activity will not stop with the Hawkeye contract. It will continue operating to handle any other offset contracts that might be negotiated in connection with military purchases abroad.

[Boxed material]

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Precedent: AWACS Contract

Asking for industrial offsets in exchange for the purchase of military equipment abroad is not something new in France. That need was very strongly expressed in connection with the contract covering acquisition of the four AWACS radar aircraft (E-3F) from Boeing.

But when that contract was signed, there were no formal guarantees regarding offsets. There was simply a letter of intent signed by Boeing and stating that 120 percent of the amount of the contract would be "offset" by purchases of CFM56 engines, plus another 10 percent described as reflecting "best efforts." It took some tough negotiating to reach the final result, which stipulated that 80 percent of the amount was to be offset by engine purchases, with another 50 percent to be spent on equipment items other than engines.

The upshot was that the 130 percent in offsets that was finally agreed to (a total of \$915 million, or Fr5.5 billion) was divided between \$563 million for the CFM56 engines—which would have been bought by Boeing in any case—and \$352 million for other contracts. Those offsets were to be spread over eight years beginning in February 1987. But six years later, in July 1993, Boeing had lived up to all its commitments. The engine portion of the deal obviously exceeded the quota, while \$353 million (Fr2.1 billion) worth of contracts had been declared "eligible." Only 38 percent of that amount was concerned with aeronautical or defense equipment; the rest went for other industrial equipment. Meanwhile, GIFAS, which was managing those offsets, had declared \$272 million (Fr1.6 billion) worth of contracts "ineligible."

France: Matra Defense Espace's 1995 Activities Summarized

95WS0183A Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 6 Jan 95 p 45

[Article by Francois Heisbourg, former director of the London Institute of Strategic Studies and currently director of strategic development for Matra Defense Espace of France: "A New Strategic Deal"]

[FBIS Translated Text] For Matra Defense Espace (MDE), 1995 will be marked by three events reflecting the culmination of efforts to meet the demands of the new strategic context. First, delivery of the Helios 1A military observation satellite means that France and its Italian and Spanish partners will become self-sufficient in an area that is crucial to the effective exercise of their post-Cold War sovereignty.

Second, the selection by the French Ministry of Defense of a subsonic missile for the "Long-Range Precision Weapon" [APTGD] means that the manufacturer acting as prime contractor will have a particularly important responsibility. The APTGD constitutes the principal new

program under the planning law. This stealth cruise missile will make it possible to hit targets of political or military importance with great accuracy while controlling collateral damage.

This year will also see the selection of the British counterpart to the anti-infrastructure Apache missile—that is, the CASOM [Conventionally Armed Stand-Off Missile] missile, which opens up major prospects for French-British industrial cooperation.

Third, the continuation of its policy of Europeanizing its core activities means that the MDE will strengthen not only its presence in the European and export markets, but also that it will be able to improve its ability to

France: New Head of Research at Aerospatiale Profiled

BR0103151795 Paris AFP SCIENCES in French 22 Feb 95 p 18

[FBIS Translated Text] Mr. Serge Catoire, 39 years old, has been appointed head of Aerospatiale's research and technology department, following the group's reorganization. He succeeds Mr. Jacques Balazard who has become adviser to the president.

Mr. Catoire previously held several positions within the French Administration, namely at the Industry Ministry's Directorate for Hydrocarbons (1986-1990). He then became a technical adviser in charge of international affairs, industrial research, and technology in Research Minister Hubert Curien's cabinet. He joined Aerospatiale in 1990 and was responsible for the Saint-Nazaire aircraft production unit and, afterward, for the A-330/A-340 Airbus program at the Airbus program directorate.

Germany: Bangemann Supports Less Expensive RDT Tariffs

95P60117A Munich COMPUTERWOCHE in German 17 Feb 95 p 23

[Unattributed article: "Bangemann Supports Less Expensive RDT Tariffs"]

[FBIS Translated Text] In the opinion of EU industry commissioner Martin Bangemann, data transmission in Germany must become more efficient and less expensive. "Transmission costs are ten times more expensive than in the United States," Bangemann explained to the Club of Hamburg of Economic Journalists regarding the problems of the local tariff situation. The competitiveness of the European countries will be determined by the extent to which and at what cost new techniques become available. Bangemann cited deregulation of the markets as an important step in the new information society. A perfect example is mobile radio telephone service, which developed rapidly in the federal republic after deregulation.

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